UNITED STATES ATOMIC ENERGY COMMISSION

Nuclear Science Abstracts

Volume 10 No. 21
Abstracts 9903 - 10695
November 15, 1956

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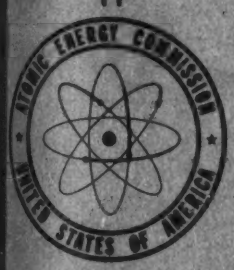

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NUCLEAR SCIENCE ABSTRACTS

Volume 10 November 15, 1956 No. 21

GENERAL

ATOMIC POWER

9903
ATOMIC ENERGY AND PROPULSION. John Cockcroft (Atomic Energy Research Establishment, Harwell, Berks, England). Atomics 7, 241-7(1956) July.

A study is made of the possibilities of harnessing atomic power to propel ships. A review of the problem from the engineering and economic aspect is given. (J.E.D.)

9904
POWER REACTOR DEVELOPMENT IN AMERICA. FUTURE PLANS OF THE ATOMIC ENERGY COMMISSION. Atomics 7, 250-4(1956) July.

The development of basic reactor technology, testing of concepts by integrated reactor experiments, and the power reactor program with the cooperation of industry are discussed. (auth)

9905
WATER FOR NUCLEAR ENGINEERING. S. K. Love and W. F. White (U. S. Geological Survey, Washington, D. C.). Ind. Eng. Chem. 48, 1248-51(1956) Aug.

The outlook for adequate supplies of water of suitable quality for nuclear energy development is more favorable in some parts of the country than in others. Competition for water in some areas is intense and may pose real limitations on the development of nuclear installations. Development engineers and other scientists responsible for expansion of nuclear engineering projects are urged to give early and thorough attention to water requirements with reference to existing or potential availability of water supplies. The program of waste disposal from nuclear installations also must be planned carefully so that receiving streams and underground waters will not be rendered dangerous or unsatisfactory for subsequent use. It is imperative that leaders in the field of nuclear engineering lend their support and actively participate in programs that have as their objective the development and conservation of water supplies for all beneficial uses including expansion of nuclear energy installations. (ICE abst.)

9906
THE PLACE OF NUCLEAR ENERGY IN UNITED KINGDOM POWER DEVELOPMENT. V. A. Pask and J. C. Duckworth. J. Brit. Nuclear Energy Conf. 1, 13-23(1956) Jan.

Electric power needs in Britain are analyzed, and the extent to which these needs must be met by nuclear power plants is discussed. A comparison of the economics of nuclear and coal generating stations is made. (D. E. B.)

9907
PROBLEMS OF MECHANICAL ANALYSIS IN REACTOR TECHNOLOGY. G. Horvay (Knolls Atomic Power Lab., Schenectady, N. Y.). New York, American Inst. of Chemical Engrs., 1956. (Preprint-355—$0.30).

The role of the structural specialist in the atomic power field is outlined, and some of his tasks at KAPL are described. Thermal stress and shock phenomena receive particular attention. Shell and perforated plate problems are also considered. A brief discussion of design principles is included. (auth)

Refer also to abstract 10546.

RESEARCH PROGRAMS

9908 P-853(RAND)
RAND Corp., Santa Monica, Calif.
SOVIET ATOMIC POLICY. Melville J. Ruggles and Arnold Kramish. May 23, 1956. 15p.

The history of nuclear research and development in the U.S.S.R. is reviewed. Scientific papers published in official journals of the Academy of Sciences and other available sources indicated an early interest in nuclear fission and active participation in theoretical and experimental work which led to the first demonstration of spontaneous fission in 1940 by two Soviet physicists. At this time there was an intensive and co-ordinated atomic research program in the Soviet Union, which was interrupted temporarily during the early war years. By 1943, the Russians had resumed an atomic development program with the apparent intent of trying to acquire nuclear weapons. From a review of papers presented at the International Conference on Atomic Energy held at Geneva in the summer of 1955 the authors reach the conclusion that the Russians may have a slight edge in some of the technological phases of the non-military applications of atomic energy. (C.H.)

9909
THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY AND ITS FUNCTIONS. John Cockcroft (Atomic Energy Research Establishment, Harwell, Berks, England). J. Brit. Nuclear Energy Conf. 1, 3-12(1956) Jan.

The research and industrial applications program of the United Kingdom AEA are reviewed, and the extent of industrial participation is discussed. Brief descriptions and photographs of existing and proposed power and research reactors are given. (D.E.B.)

BIOLOGY AND MEDICINE

9910
PNEUMO-THYROID. A NEW PROCEDURE FOR DETERMINING THE MASS OF THE THYROID GLAND FOR THE RADIOIODINE TREATMENT OF HYPERTHYROIDISM. Victor Hugo Franco and Mario Gentil Quina (Instituto Portgues de Oncologia, Lisbon, Portugal). Brit. J. Radiol. 29, 434-9(1956) Aug.

A procedure is presented for the visualization of the thyroid gland by radiographic methods, using a gaseous contrast (oxygen) insufflated into the infra-hyoid region. This method has been used in order to calculate directly the mass of the thyroid gland as one of the factors involved in the radioiodine treatment of hyperthyroidism. Some results are presented which confirm the importance of the correct assessment of the thyroid gland mass to more accurate dosimetry. It is believed that the method may be useful to the laryngologist since it permits visualization of the external surface of the larynx. (auth)

9911
INFLUENCE OF PARATHYROID EXTRACT, CORTISONE AND DIENESTROL DIACETATE ON METABOLISM OF CESIUM IN RATS. F. Mraz, Marie LeNoir, J. Pinajian, and H. Patrick (U. S. Atomic Energy Commission Agri-

cultural Research Program, Oak Ridge, Tenn.). Arch Biochem. Biophys. 63, 73-6(1956) July.

The effects of parathyroid extract, cortisone, and dienestrol diacetate on cesium extraction in rats, were studied. Parathyroid increases urine flow and decreases Cs excretion by the kidneys; 100 mg cortisone increases excretion but 50 mg decreases excretion. Dienestrol diacetate increases Cs retention by muscle, femur, liver, kidney, and spleen. (F.S.)

9912

THE RELATIONSHIP OF THE CELL SURFACE TO METABOLISM. XIII. THE CATION-BINDING PROPERTIES OF THE YEAST CELL SURFACE. A. Rothstein and A. D. Hayes (Univ. of Rochester School of Medicine and Dentistry, N. Y.). Arch. Biochem. Biophys. 63, 87-99(1956) July.

The binding of exogenous bivalent and univalent cations by the yeast cell is rapid and reversible, obeying a simple mass-law equation. Bivalent cations, especially UO_2^{++}, are bound more firmly than are univalent cations. There are at least two species of binding sites, tentatively identified as phosphoryl and carboxyl groups. These are located at the periphery of the cell, isolated from endogenous cations by a permeability barrier. (auth)

9913

THE EFFECT OF ANHYDROUS STRONG ACIDS ON RIBONUCLEASE AND LYSOZYME. Arthur L. Koch, William A. Lamont, and Joseph J. Katz (Argonne National Lab., Lemont, Ill. and Univ of Chicago). Arch. Biochem. Biophys. 63, 106-17(1956) July.

Ribonuclease and lysozyme may be dissolved and recovered from various anhydrous acid media indistinguishable in certain physical and enzymatic properties from the original, provided the temperature is kept low and the time of exposure reasonably short. With higher temperatures and longer times, inactivation occurs. Ultracentrifugal data on recovered material have been obtained and the ninhydrin color yield per mole of protein measured. Model experiments on disulfide linkages indicate strongly that such bonds are stable in hydrogen fluoride solution. On the basis of these results, it is concluded that inactivation is probably associated with the splitting of a small number of peptide bonds without causing a decrease in molecular weight but leading to an increase in hydrodynamic volume. (auth)

9914

METEOROLOGICAL VARIABLES AND THE NORTHWARD MOVEMENT OF NOCTURNAL LAND BIRD MIGRANTS. Gilbert S. Raynor (Brookhaven National Lab., Upton, N. Y.). The AUK 73, 153-75(1956) Apr.

9915

BONE METABOLISM. III. THE EFFECT OF VARIOUS DIETS ON THE MOBILIZATION OF STRONTIUM FROM THE RAT SKELETON. Robert D. Ray, Dorothy E. Stedman, and Norvelle K. Wolff (Univ. of Washington School of Medicine, Seattle). J. Bone and Joint Surg. 38A, 637-54(1956) June.

A study has been carried out to determine the effect of various diets on body growth, histological structure of bone, and chemical composition and mobilization of Sr from the skeletons of young growing rats. Animals having from 5 to 6% of the mineral portion of their skeletons as Sr were maintained on a standard laboratory diet, a low-protein diet, a high-calcium and high-vitamin-D diet, a subminimal-phosphorus diet, a cereal rachitogenic diet, a cereal rachitogenic diet containing ammonium chloride, and a low-phosphorus diet. The low-phosphorus diet had the most profound effect on Sr mobilization and skeletal mineralization, while the standard diet and the low-protein diet had the least effect. (auth)

RADIATION EFFECTS

9916 PB-121305

Massachusetts Inst. of Tech., Cambridge.

DEVELOPMENT OF A METHOD OF RADIATION STERILIZATION OF FOODS WITHOUT ADVERSE FLAVOR AND CHEMICAL CHANGES. Termination Report No. 8 [for] April 1, 1954–August 31, 1955. B. E. Proctor. 109p. Project No. 7-84-01-002. Contract DA-44-109-qm-1746.

Various processing treatments (freezing, vacuum packing, packing in nitrogen gas, vacuum packing and freezing) prior to irradiation of food were tried for preventing flavor changes. With some foods some of these processing treatments were effective at a particular dose level and with other foods none of these methods was effective at the sterilizing dose level. No particular processing treatment seemed to be universally outstanding. Pre-cooking prior to irradiation did not prove to be beneficial. Data are tabulated. (C.H.)

9917 PB-121306

Wisconsin. Univ., Madison. Inst. for Enzyme Research.

INHIBITION OF ENZYMATIC ACTIVITY IN IRRADIATED FOODSTUFFS. Report No. 6 (Final) [for] January 1–December 15, 1955. David E. Green. 26p. Project No. 7-84-01-002. Contract DA-19-129-qm-257.

The effect of ionizing radiations on the enzymatic activities of a number of widely different foodstuffs has been investigated. Particular emphasis has been placed on the enzymes concerned with energy production, intermediate metabolism, and degradation of food products. The above enzymes have been found to be highly resistant to ionizing radiations. The production of a disagreeable taste, offensive odors, and undesirable color changes accompanied the irradiation of food products. (auth)

9918 PB-121307

California. Agricultural Experiment Station, Davis. Dept. of Food Technology.

RELATIONSHIP OF RADIATION INDUCED FAT OXIDATION AND FLAVOR, COLOR, AND VITAMIN CHANGES IN MEAT. Report No. 8 (Final) [for] December 31, 1954 to January 15, 1956. A. L. Tappel. 7p. Project No. 7-84-01-002. Contract DA-19-129-qm-256. $0.50.

Results are reported from a survey of chemical, physical, and organoleptic changes produced in beef, pork, poultry, and fish by sterilizing doses of radiation. Radiation sufficient to pasteurize meat was found to be without effect on flavor, whereas radiation sufficient for sterilization usually rendered the meat unacceptable. Irradiation of beef and pork in a nitrogen atmosphere eliminated formation of peroxides. Carbonyl compounds were formed when irradiation took place in either oxygen or nitrogen atmospheres. Effects of irradiation on hematin compounds, carotenoids, vitamins, enzymes, and texture are discussed. (C.H.)

9919 PB-121308

Michigan. Univ., Ann Arbor. Engineering Research Inst.

COMBINED EFFECTS OF HEAT AND RADIATION IN FOOD STERILIZATION. Report No. 9 (Termination) [for] June 7, 1954–October 6, 1955. Lloyd L. Kempe. 48p. Project No. 7-84-01-002. Contract DA44-109-qm-1826.

An investigation was made on the combined effects of heat and radiation in food sterilization. Spores of several strains of Clostridium botulinum were tested for resistance to the killing effects of heat and radiation alone, in various combinations, and in the presence of various chemical agents. (C.H.)

9920 PB-121309

American Meat Institute Foundation, Chicago.

CHEMISTRY OF COLOR, FLAVOR, AND ODOR CHANGES

IN IRRADIATING MEAT. Termination Report No. 6 [for] April 1, 1954 to September 30, 1955. B. S. Schweigert. 16p. Project No. 7-84-01-002. Contract DA-44-109-qm-1757.

Data are presented from studies on the nature of chemical changes that occur in meat during irradiation that may be associated with the production of undesirable color, flavor, and odor. Fresh ground beef and fresh pork tenderloin were exposed to approximately 2 to 10 million rep with the use of Co^{60} or the Idaho Falls γ ray sources. Data are tabulated. (C.H.)

9921 PB-121310

Ohio State Univ. Research Foundation, Columbus. CHEMICAL AND ORGANOLEPTIC CHANGES IN CARBOHYDRATES AND PROTEINS PRODUCED BY RADIATION STERILIZATION. Termination Report No. 9 [for] April 20, 1954 to October 19, 1955. M. L. Wolfrom. 79p. Project No. 7-84-01-002. Contract DA-44-109-qm-1772.

Changes in carbohydrates and proteins produced by sterilizing doses of radiation were investigated. The materials were irradiated in the dry state, in solutions, and under various temperature conditions. Data are tabulated. (C.H.)

9922 PB-121313

California. Univ., Berkeley. EFFECT OF IONIZING RADIATIONS OF CAROTENOID STABILITY. Report No. 3 (Final) [for] November 15, 1954 to February 29, 1956. G. Mackinney. 10p. Project No. 7-84-01-002. Contract DA-19-129-qm-254.

The destruction of carotenoid pigments on exposure to gamma-radiation is caused by secondary reactions and depends upon the extent to which free radicals of peroxides formed in the surrounding medium are available for reaction. The loss of carotenoids in irradiated whole tomatoes is small even at dosages of several million rep, but the internal structure of the tomato is destroyed, and the problem is therefore one of pectin and carbohydrate instability. Three carotenoid-containing oils were tested, namely that extracted from the carrot root, corn oil, and salmon oil. The carotenoid in carrot root oil was very stable, and of the three oils tested, salmon oil was least stable. Crystalline carotene and lycopene, dissolved in petroleum ether solution, in the absence of an antioxidant, are highly unstable. Stability was also markedly decreased, as would be anticipated, when pure beta-carotene was dissolved in methyl stearate, methal oleate, and methyl linoleate, respectively, in the order mentioned. Films of pure beta-carotene and lycopene in the solid state appear to be remarkably stable, even in the presence of air, and we conclude that where destruction occurs, it is initiated by products of other reactions, normally to be sought in the lipide fraction. (auth)

9923 UR-445

Rochester, N. Y. Univ. Atomic Energy Project. SOME LATE EFFECTS OF EXTERNAL RADIATION ON GROWING AND ADULT MAMMALS. J. B. Hursh and T. R. Noonan. Aug. 16, 1956. 15p. Contract W-7401-eng-49. $3.30(ph OTS); $2.40(mf OTS).

A survey has been made of reports dealing with the changes in post-natal growth and development and the persistent morphological effects (other than carcinogenesis and cataract induction) associated with exposure of mammals to external ionizing radiation. The most pertinent data have been presented in tabular form. On the basis of presently published information, it is concluded that growth may be slowed, development may be retarded, and distinct and persistent changes may be produced in various tissues by radiation exposures which are not acutely lethal. It would seem, however, that the production of these effects requires exposures to external radiation which probably exceed those believed to produce an undesirably high incidence of genetic changes and definite impairment of spermatogenesis. Except for problems associated with the clinical application of x rays, therefore, it does not seem that the effects here considered are likely to determine the limit for maximal permissible exposure. (auth)

9924 USNRDL-TR-98

Naval Radiological Defense Lab., San Francisco. INCREASED URINARY EXCRETION OF TAURINE AND UREA BY RATS FOLLOWING X-IRRADIATION. R. E. Kay, J. C. Early, and C. Entenman. July 10, 1956. 22p. Project No. 006-015.

The effect of whole-body x irradiation on the daily and hourly excretion of urea, taurine, sulfate, and creatinine wa was investigated in the fasting rat. Exposure to whole-body x irradiation results in an increase in the daily excretion of taurine, urea, and sulfate, but not in the daily excretion of creatinine. At all doses investigated (75 to 2500 r) the greatest excretion of urea and taurine was evident on the day following x irradiation. For doses up to 250 r the daily excretion of taurine, urea, and sulfate increased with increasing dose, while at doses greater than 250 r there was no further increase. On an hourly basis, excessive taurine and urea excretion was evident within 3 hr after the time of irradiation and the peak excretion rate for both compounds occurred 5 hr after irradiation. Following the time of peak excretion the hourly elimination of taurine declined rapidly, while that of urea decreased gradually. Increases in the hourly excretion rate of sulfate and creatinine were not observed. Adrenalectomy prevented the daily increases in urea and sulfate excretion, but did not prevent the increase in taurine excretion. (auth)

9925 USNRDL-TR-99

Naval Radiological Defense Lab., San Francisco. URINARY PURINE EXCRETION IN THE X-IRRADIATED DOG. K. Jackson and C. Entenman. June 7, 1956. 25p. Project NM 006-015.

Urinary excretion of purine bases by the dog following whole-body x irradiation was studied. Ion exchange chromatography with Dowex-50 was used to measure uric acid, xanthine, hypoxanthine, guanine, 7-methylguanine, and adenine. Changes in the excretion of uric acid and xanthine were noted during the first 24 hr following irradiation. Uric acid excretion was increased following doses between 150 and 500 r. Xanthine excretion increased markedly following supralethal doses but not after midlethal doses. Total purine excretion (allantoin plus uric acid) was increased slightly following irradiation and the degree of the increase was not related to the radiation dose. Possible mechanisms for these changes are discussed. (auth)

9926 USNRDL-TR-100

Naval Radiological Defense Lab., San Francisco. MODIFICATION OF POST-IRRADIATION VOLITIONAL ACTIVITY PERFORMANCE. I. THE VOLITIONAL ACTIVITY RESPONSE OF RATS TO PARTIAL-BODY X IRRADIATION. II. THE EFFECT OF BONE MARROW THERAPY UPON THE VOLITIONAL ACTIVITY OF WHOLE-BODY X-IRRADIATED RATS. D. C. Jones, D. J. Kimeldorf, G. K. Osborn, T. J. Castanera, and D. O. Rubadeau. June 29, 1956. 29p. Project NM 006-015.

9927 AEC-tr-2634

EFFECT OF IONIZING RADIATIONS UPON POLIOMYELITIS VIRUS SK. Communication No. 2. G. Comba Ezquerra. Translated from Bol. radiactividad (Madrid) 25, 79-92(1952-53). 16p.

Results are reported from an investigation of the effects

of radiation on the virulence of poliomyelitis virus in rats. (See also NSA 9-491.) (C.H.)

9928

X-RAY-INDUCED DEVELOPMENTAL ABNORMALITIES IN THE MOUSE AND THEIR USE IN THE ANALYSIS OF EMBRYOLOGICAL PATTERNS. II. ABNORMALITIES OF THE VERTEBRAL COLUMN AND THORAX. Liane Brauch Russell (Oak Ridge National Lab., Tenn.). J. Exptl. Zool. 131, 329-95(1956) Apr.

Abnormalities in the vertebral column and thorax of newborn mice are described which were produced by x irradiation during embryonic development. (C.H.)

9929

STUDIES ON AGED SEEDS. III. SENSITIVITY OF AGED WHEAT SEEDS TO X-RADIATION. R. A. Nilan and Helga M. Gunthardt (State Coll. of Washington, Pullman). Caryologia 8, No. 2, 316-22(1956). (In English)

9930

MITOTIC INHIBITION AND CHROMOSOME BREAKAGE IN SALAMANDERS OF THE GENUS GYRINOPHILUS. Doris L. Craig, J. S. Kirby-Smith, and J. N. Dent (Oak Ridge National Lab., Tenn. and Univ. of Virginia, Charlottesville). Trans. Am. Microscop. Soc. 75, 234-41(1956) Apr.

9931

INDUCTION OF TUMORS BY IONISING RADIATION ON STEMS, LEAVES AND ROOTS OF AN INTERSPECIFIC NICOTIANA HYBRID. Arnold H. Sparrow and James E. Gunckel (Brookhaven National Lab., Upton, N. Y. and Rutgers Univ., New Brunswick, N. J.). Pp. 485-8 in "Progress in Radiobiology". London, Oliver and Boyd, 1956.

9932

TUMOR FORMATION AND OTHER MORPHOGENETIC RESPONSES IN AN AMPHIDIPLOID TOBACCO HYBRID EXPOSED TO CHRONIC GAMMA IRRADIATION. Arnold R. Sparrow, James E. Gunckel, Lloyd A. Schairer, and George L. Hagen (Brookhaven National Lab., Upton, N. Y.). Am. J. Botany 43, 377-88(1956) May.

9933

RADIOACTIVE GOLD IN THE SUBARACHNOID SPACE OF THE DOG. Sidney Rubenfeld and Bertram E. Zeitel (New York Univ. Coll. of Medicine). Am. J. Roentgenol. Radium Therapy Nuclear Med. 76, 367-71(1956) Aug.

9934

REDUCED GENE TRANSMISSION IN RADIATION-INDUCED MUTANT BARLEY. C. C. Moh and R. A. Nilan (Smithsonian Institution, Washington, D. C. and State Coll. of Washington, Pullman). J. Heredity 47, No. 3, 129-31(1956) May-June.

9935

CROSS REACTIVATION OF DEUTERON BOMBARDED T1 BACTERIOPHAGE. J. E. Till and Ernest Pollard (Yale Univ., New Haven, Conn.). Arch. Biochem. Biophys. 63, 260-2(1956) July.

Cross reactivation of T1 bacteriophage by deuterons was studied. About 60% of the genetic part of the phage is essential for cross reactions. The sensitive region is long and thin, similar results were obtained with x-rays. (F.S.)

9936

NOTE ON FITTING THE MULTI-HIT SURVIVAL CURVE. Joan M. Gurian (Argonne National Lab., Lemont, Ill.). Biometrics 12, No. 2, 123-6(1956) June.

9937

NECESSITY OF INDOLEACETIC ACID FOR THE DUPLICATION OF CROWN-GALL TUMOR CELLS. Richard M. Klein and Howard H. Vogel, Jr. (New York Botanical Garden, N. Y. and Argonne National Lab., Lemont, Ill.). Plant Physiol. 31, 17-22(1956) Jan.

The reduction of the endogenous or biologically effective level of IAA in crown-gall tumor tissues was accomplished in vivo and in vitro by the use of ionizing radiations (x-rays, gamma rays, and fast neutrons) and by the use of a specific anti-auxin. In all cases, the primary effects were a reduction in the growth of the tissues. These inhibitions of growth could be reversed wholly or in part by supplying the tumor cells with appropriate concentrations of IAA. These results give presumptive evidence that IAA may be specifically required for the duplication of crown-gall tumor cells which presumably synthesize optimal amounts of auxin. (auth)

9938

STUDY OF THE ADENOSINETRIPHOSPHATIC AND HEXOKINASIC ACTIVITY OF THE CRYSTALLINE LENS OF RABBITS SUBJECTED TO LOCAL X IRRADIATION. P. Mandel and M. L. Schmitt (Universite de Strasbourg). Experientia 12, 223-4(1956) June. (In French)

9939

RADIOSENSITIVITY OF LARVAL AND ADULT AMPHIBIA IN RELATION TO TEMPERATURE DURING AND SUBSEQUENT TO IRRADIATION. John P. O'Brien and Walter L. Gojmerac (Marquette Univ., Milwaukee, Wis.). Proc. Soc. Exptl. Biol. Med. 92, 13-16(1956) May.

9940

PROTECTIVE EFFECT OF PRE-IRRADIATION ON LYMPHOCYTIC CHORIOMENINGITIS INFECTION IN MICE. Wallace P. Rowe (Naval Medical Research Inst., Bethesda, Md.). Proc. Soc. Exptl. Biol. Med. 92, 194-8(1956) May.

9941

INFLUENCE OF TESTIS ON INDUCTION OF OVARIAN TUMORS OF MICE BY X-RAYS. Arthur Kirschbaum, Annabel G. Liebelt, and Gilbert H. Fletcher (Baylor Univ. Coll. of Medicine; Univ. of Texas M. D. Anderson Hospital and Tumor Inst.; and Texas Medical Center, Houston). Proc. Soc. Exptl. Biol. Med. 92, 221-2(1956) May.

9942

EFFECT OF TOTAL BODY X-IRRADIATION ON THE PARAKEET. Hans G. Schlumberger and Ulrich K. Henschke (Ohio State Univ. Coll. of Medicine, Columbus). Proc. Soc. Exptl. Biol. Med. 92, 261-6(1956) June.

9943

EFFECTS OF X-IRRADIATION ON ANDROGENIC RESPONSE OF SEMINAL VESICLES OF THE CASTRATE RAT. R. M. Melampy, J. W. Gowen, and J. W. Wacasey (Iowa Agricultural Experiment Station, Ames). Proc. Soc. Exptl. Biol. Med. 92, 313-15(1956) June.

9944

RELATION OF GONAD HORMONES TO X-IRRADIATION SENSITIVITY IN MICE. Roberts Rugh and Joan Wolff (Columbia Univ., New York). Proc. Soc. Exptl. Biol. Med. 92, 408-10(1956) June.

9945

LEUKEMIA INDUCTION IN MICE BY FAST NEUTRON IRRADIATION. A. C. Upton, G. S. Melville, Jr., M. Slater, F. P. Conte, and J. Furth (Oak Ridge National Lab., Tenn.). Proc. Soc. Exptl. Biol. Med. 92, 436-8(1956) June.

9946

EFFECTS OF RADIATION ON MAMMALS. E. P. Cronkite and V. P. Bond (Brookhaven National Lab., Upton, N. Y.). Ann. Rev. Physiol. 18, 483-526(1956).

9947

INFLUENCE OF IONIZING RADIATION ON THE APPEARANCE IN THE SERUM OF RABBITS OF HUMORAL FAC-

TORS SLOWING DOWN CELL DIVISION. J. Müller (Inst. of Industrial Hygiene and Occupational Diseases, Prague). Nature 178, 43-4(1956) July 7.

9948

PROTECTION FROM WHOLE-BODY X-IRRADIATION AFFORDED TO ADULT MICE BY REDUCING THE BODY TEMPERATURE. Shirley Hornsey (Hammersmith Hospital, London). Nature 178, 87(1956) July 14.

The survival rate after whole-body irradiation of newborn rats and mice was increased by reducing the body temperature to 2 to 5°C at irradiation. Adult rats had a slight reduction in sensitivity to whole-body irradiation by reducing their body temperature to 18 to 19°C. Higher doses than 1500 r at reduced body temperature were not attempted so the degree of protection given by this treatment has not been established. (F.S.)

9949

STUDIES ON THE LETHAL EFFECT OF INCORPORATED P^{32} AND S^{35} IN NEUROSPORA CRASSA. B. S. Strauss, Tiiu Vaharu, P. Frickey, and J. Matheson (Syracuse Univ., N. Y. and Brookhaven National Lab., Upton, N. Y.). Radiation Research 5, 25-38(1956) July.

9950

TEMPERATURE DEPENDENCE OF BACTERIAL INACTIVATION BY X-RAYS. G. E. Stapleton and C. W. Edington (Oak Ridge National Lab., Tenn.). Radiation Research 5, 39-45(1956) July.

9951

SIMILARITIES IN KILLING BY HEAT AND BY X-RADIATION IN THE INSECT DAHLBOMINUS FUSCIPENNIS (ZETT.). William F. Baldwin (Atomic Energy of Canada Ltd., Chalk River, Ont.). Radiation Research 5, 46-51(1956) July.

Parallels in response to heat and to x irradiation were shown in the insect Dahlobominus fuscipennis (Zett.). The immediate consequence of high doses in both cases is a coma from which the insects may recover, to die later of the delayed effects. Tolerance diminishes with age; prior conditioning with moderately high temperatures increases female tolerance; diploid females are more resistant than haploid males; sharp breaks were found in curves relating dose and effect. All these observations are true for both agents. (auth)

9952

MITOTIC INHIBITION AND CHROMOSOME BREAKAGE INDUCED IN GRASSHOPPER NEUROBLASTS BY X-IRRADIATION AT KNOWN MITOTIC STAGES. W. St. Amand (Univ. of Tennessee, Knoxville and Oak Ridge National Lab., Tenn.). Radiation Research 5, 65-78(1956) July.

9953

EFFECTS OF IONIZING RADIATIONS ON PLANT TISSUES. I. QUANTITATIVE MEASUREMENTS OF THE SOFTENING OF APPLES, BEETS, AND CARROTS. R. E. Glegg, Frank P. Boyle, L. W. Tuttle, D. E. Wilson, and Z. I. Kertesz (Cornell Univ., Geneva, N. Y.). Radiation Research 5, 127-33(1956) Aug.

The pressure required to crush small cylinders of plant tissues was measured objectively. Up to a certain level of γ-irradiation no measurable softening occurs in apple, beet, and carrot cylinders Beyond this level of irradiation, progressive softening of the tissues takes place. The crushing loads obtained in the softening phase plotted against log roentgens give straight lines. These straight-line plots allow graphical interpolation of threshold dosages of irradiation, which were 34,700, 166,000, and 316,000 r for the varieties of apples, carrots and beets investigated. (auth)

9954

AN APPLICATION OF INFORMATION THEORY TO THE PHYSICS OF TISSUE DAMAGE. Hubert P. Yockey (Oak Ridge National Lab., Tenn.). Radiation Research 5, 146-55 (1956) Aug.

A method is presented for calculating the relation between life span, dose, and dose rate of ionizing radiation in radiation injuries in mammals. (C. H.)

9955

PROTEIN CONTENT AND COMPOSITION OF RAT SERUM AS RELATED TO AMOUNT OF WHOLE-BODY X-IRRADIATION. C. Winkler and G. Paschke (Röntgenabteilung der Chirurgischen-Universitäts-Klinik, Bonn, Germany). Radiation Research 5, 156-61(1956) Aug.

This article gives a brief report on electrophoretic examination of rat blood serum after various high doses of x radiation. It is shown that characteristic changes in the serum protein composition occur in accordance with the amount of the dose. Therefore it can be assumed that it is possible, from the manner and degree of the changes in connection with the time necessary for their formation, to determine the degree of destruction caused by the irradiation. (auth)

9956

THE FATE OF RADIATION-INDUCED LETHALS IN A YEAST POPULATION. A. P. James and C. E. Chaplin (Atomic Energy of Canada Ltd., Chalk River, Ont. and Bacteriology Div., Science Service, Ottawa). Radiation Research 5, 162-6(1956) Aug.

A method of studying the effect of radiation-induced recessive lethals on the well-being of heterozygotes in an asexually multiplying population of diploid yeast is described. Results of an experiment showed that it is only in the early generations after irradiation that the frequency of heterozygotes can serve as a measure of the phenotypic effect of a representative sample of induced lethals. Of more than 10^7 independent lethals, none conferred the selective advantage possessed by two initially lethal-free but abnormally sporulating variants that arose in the population. Results indicated that a large part of the decline in frequency of heterozygotes in the first five generations may be thought of as due to partial dominance of recessive lethals. (auth)

9957

ELECTROLYTE METABOLISM AFTER TOTAL-BODY X-IRRADIATION. W. O. Caster and W. D. Armstrong (Univ. of Minnesota, Minneapolis). Radiation Research 5, 189-204(1956) Aug.

9958

NUCLEIC ACID AND SUCCINIC DEHYDROGENASE OF RAT LIVER AFTER X-IRRADIATION. Leon L. Gershbein and Boguslaw K. Krotoszynski (Illinois Inst. of Tech, Chicago). Science 124, 81-2(1956) July 13.

No remarkable alterations were observed in the succinic dehydrogenase and nucleic acid levels of x-irradiated intact rat liver. (C.H.)

9959

RADIOACTIVE FALLOUT THROUGH SEPTEMBER 1955. Merril Eisenbud and John H. Harley (U. S. Atomic Energy Commission, New York). Science 124, 251-5(1956) Aug. 10.

Data are summarized from the monitoring network in 1955 to show the cumulative surface deposits of mixed fission products and Sr^{90}, and the cumulative gamma dose in millirads from external radiation caused by radioactive fallout. (F. S.)

9960

THE RELATION OF POPULATION HETEROGENEITY TO THE PLATEAU PHENOMENON IN RADIATION DOSE-RESPONSE CURVES. David D. Pittman (Southern Illinois Univ., Carbondale). J. Bacteriol. 71, 500-1(1956) Apr.

9961
THE EFFECT OF X-RAYS ON THE SURVIVAL OF BACTERIA AND YEAST. I. A COMPARATIVE STUDY OF THE DOSE-SURVIVAL CURVES OF AZOTOBACTER AGILE, ESCHERICHIA COLI, PSEUDOMONAS FLUORESCENS, RHODOPSEUDOMONAS SPHEROIDES, AND SACCHAROMYCES CEREVISIAE IRRADIATED IN THE RESTING STATE. Shirley E. Gunter and Henry I. Kohn (Univ. of California School of Medicine, San Francisco). J. Bacteriol. 71, 571-81(1956) May.

9962
EFFECT OF TOTAL BODY X-IRRADIATION ON PLASMA VOLUME, RED CELL VOLUME, BLOOD VOLUME AND THIOCYANATE SPACE IN NORMAL AND SPLENECTOMIZED RATS. Kee-Chang Huang and James H. Bondurant (Univ. of Louisville School of Medicine, Ky.). Am. J. Physiol. 185, 446-9(1956) June.

9963
BIOSYNTHESIS OF FATTY ACIDS IN LIVER AND INTESTINE OF INTACT NORMAL, FASTED AND X-IRRADIATED RATS. John G. Coniglio, Donald B. McCormick, and Granville W. Hudson (Vanderbilt Univ. School of Medicine, Nashville). Am J. Physiol. 185, 577-82(1956) June.

9964
MEDICAL EFFECTS OF THE ATOMIC BOMB IN JAPAN. National Nuclear Energy Series, Division VIII, Volume 8. Ashley W. Oughterson and Shields Warren, eds. New York-Toronto-London, McGraw-Hill Book Co., 1956. $8.00.

Data are summarized from a survey of the property damage and pathological effects on the populations of the atomic explosions at Hiroshima and Nagasaki. Although the bomb used against Hiroshima was composed of U^{235} and the one used against Nagasaki had Pu^{239} as its essential component, the types of damage produced were similar. Each explosion resulted in mechanical, thermal, and ionizing radiation injuries, usually in various combinations. Structural conditions and disposition of the populations in the two cities were widely diverse, so no comparison of the relative efficiency of each bomb can be drawn. Structural damage to buildings and clinical condition of the survivors at various times following the explosions are illustrated photographically. (C.H.)

Refer also to abstract 10057.

RADIATION HAZARDS AND PROTECTION

9965 AECD-3732
[Los Alamos Scientific Lab., N. Mex.].
OPERATING REGULATIONS FOR THE PAJARITO REMOTE CONTROL LABORATORIES. H. C. Paxton, E. C. Mallary, and L. S. Horvath. [1955?]. Decl. Jan. 18, 1956. 13p. Contract [W-7405-eng-36]. $0.15(OTS).

Procedural regulations are presented for the safe handling of fissionable materials. The most important concern of the regulations is the control of personnel hazard, but the protection of valuable fissionable materials is also considered. (C.H.)

9966 AERE-HP/L-23
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
A SHORT COURSE IN RADIOLOGICAL PROTECTION. R. J. Sherwood and H. J. Dunster, eds. June 1956. 103p.

9967 TID-5360
Division of Organization and Personnel. Safety and Fire Protection Branch, AEC.
A SUMMARY OF ACCIDENTS AND INCIDENTS INVOLVING RADIATION IN ATOMIC ENERGY ACTIVITIES, JUNE 1945 THROUGH DECEMBER 1955. Daniel F. Hayes. Aug. 1956. 79p. $0.45(OTS).

Criticality incidents, reactor incidents, contamination incidents, fires and explosions involving radioactive material, and miscellaneous accidents involving radiation which occurred from June 1945 through Dec. 1955 are described. Safety measures resulting from review of the accidents are included. (C.H.)

9968
COMPARATIVE ACTIVITY OF ISOLOGOUS VS. HOMOLOGOUS MOUSE BONE MARROW IN PROMOTING REGENERATION OF THE IRRADIATED MOUSE THYMUS. Barbara B. Hirsch, Mary B. Brown, C. Susan Nagareda, and Henry S. Kaplan (Stanford Univ. School of Medicine, San Francisco). Radiation Research 5, 52-7(1956) July.

9969
RESPONSES TO WHOLE-BODY X-IRRADIATION IN THE STARVED RAT. L. F. Nims and J. L. Geisselsoder (Brookhaven National Lab., Upton, N. Y.). Radiation Research 5, 58-64(1956) July.

9970
PROTECTION BY SODIUM HYDROSULFITE AGAINST X-RAY-INDUCED MITOTIC INHIBITION IN GRASSHOPPER NEUROBLAST. E. I. Shaw (Oak Ridge National Lab., Tenn.). Proc. Soc. Exptl. Biol. Med. 92, 232-6(1956).

9971
DOSAGES FROM NATURAL RADIOACTIVITY AND COSMIC RAYS. W. F. Libby. Science 122, 57-8(1955) July 8.

Radiation dosage from natural radioactivities and cosmic rays were calculated. Data are tabulated on the total radiation dosage expressed in mr/yr for exposures at various altitudes directly over ordinary granite, typical sedimentary rock, and open oceans; cosmic ray dosages at various altitudes; radiation dosage from the natural radioactivity of the human body; and radiation dosages received in various ordinary circumstances. Comparison is made with data compiled by various investigators throughout the world and the average exposure rate from total fall-out from atomic tests on the United States on 1 January 1955. (C.H.)

9972
POSTIRRADIATION PROTECTION OF RABBITS BY INJECTION OF "SPLENIC" PLASMA. Bruce R. Allen, H. Gwendolyn Wardell, and Michael Clay (Columbia Univ., N. Y.). Science 123, 1080-1(1956) June 15.

9973
THE ROLE OF TRANSFUSED LEUKOCYTES IN EXPERIMENTAL BACTEREMIA OF IRRADIATED RATS. J. W. Hollingsworth, Stuart C. Finch, and Paul B. Beeson (Yale Univ. School of Medicine, New Haven). J. Lab. Clin. Med. 48, 227-36(1956) Aug.

9974
THE DESIGNER AND RADIATION PROTECTION. H. J. Dunster (Atomic Energy Research Establishment, Harwell, Berks, England). Nuclear Eng. 1, 144-8(1956) July.

When designing equipment and processes for the handling of radioactive materials consideration must be given to safety from direct radiation and contamination, concomitant with flexibility of operation and feasibility of maintenance. The designer must work in collaboration with specialists and understand the various problems that are involved. (auth)

9975
RADIOGRAPHIC EXAMINATIONS AND RADIATION DANGERS. J. Camerman. J. belge radiol. 39, No. 2, 165-78(1956). (In French)

A chart is given of roentgen-ray dose rates (skin and depth doses) the patient and the radiologist may receive during the different procedures of roentgen diagnosis. It shows that these investigations offer no harm for the

patient provided special care is given in cases of abnormally long exposure time and perhaps in roentgen diagnosis of the pelvis in young women. Radiologists and assistants should be warned against secondary radiation which is more important than generally admitted. Skin and depth doses to the patient as well as secondary radiation to the radiologist are largely reduced by the hard radiation technique (100 to 130 kv) which therefore justifies its use. (auth)

9976

HEALTH AND SAFETY IN A NUCLEAR POWER INDUSTRY. A. S. McLean and W. G. Marley. J. Brit. Nuclear Energy Conf. 1, 24-34(1956) Jan.

A short review of the general effects of radioactivity and ionizing radiation on human beings is given, and the basic problems of radiation protection are stated. The various features of nuclear power development, such as the nuclear reactors, chemical separation plants and waste-disposal facilities, are examined in relation to their potential occupational and public health hazards and these are compared with the health and safety problems arising elsewhere in industry. The extensive experience of the Atomic Energy Authority in this field is reviewed and used to indicate the type of protective measures and procedures which are likely to be effective in ensuring continued safe development in the new industry. (auth)

9977

RELATIONSHIP OF CATALASE AND SODIUM NITRITE TO PROTECTION AGAINST X-RAYS. C. S. Bachofer (Univ. of Notre Dame, Ind.). Exptl. Cell Research 10, 665-74(1956) June.

9978

CIRCULATING RAT CELLS IN LETHALLY IRRADIATED MICE PROTECTED WITH RAT BONE MARROW. Takashi Makinodan (Oak Ridge National Lab., Tenn.). Proc. Soc. Exptl. Biol. Med. 92, 174-9(1956) May.

9979

RADIATION PROTECTION—INSURANCE AND INDUSTRIAL RELATIONS ASPECTS. Charles R. Williams (Liberty Mutual Insurance Co., Boston). Am. Ind. Hyg. Assoc. Quart. 17, 214-20(1956) June.

The insurance phase of the reactor program is reviewed. (C.H.)

9980

GROUND LEVEL CONTAMINATION FROM STACK EFFLUENTS. P. B. Klevin, M. S. Weinstein, and W. B. Harris (U.S.A.E.C. Health and Safety Lab., New York). Am. Ind. Hyg. Assoc. Quart. 17, 189-92(1956) June.

Soil sample surveys were conducted at three AEC facilities to determine the concentration gradients of uranium in the soil with respect to depth, distance, and direction from the source of pollution. These plants have been in operation for over 14 years and have discharged 18.5, 50, and 52 tons respectively of U as metal in the stack effluents. About 40% by weight of the effluent was estimated to be still in the ground at the two plants where the discharge was largely insoluble material. The soluble salts remained only to the extent of about 1.2%. The maximum average concentration of uranium was about 50 μg/gm at the 500 foot radius. There was no significant effect of direction from the source. The soil concentration in each case decreased linearly with distance and was within the range of normal background of U in soil beyond about 2000 feet from the center of plant activities. Plants A and B showed a soil concentration decrease approximately as the square of the distance from the source. The top inch of soil contained about two to three times the concentration of the lower 5 in. where the material was insoluble, while no difference was found where the effluent was in the form of soluble salts. (auth)

Refer also to abstract 10317.

RADIOTHERAPY

9981

SELECTIVE IRRADIATION OF LYMPH NODES BY RADIOLUTECIUM (Lu^{177}). Granvil C. Kyker, W. M. Christopherson, H. F. Berg, and Marshall Brucer (Oak Ridge Inst. of Nuclear Studies, Tenn. and Univ. of Louisville School of Medicine, Ky.). Cancer 9, 489-98(1956) May-June.

When a soluble salt of Lu^{177}, the heaviest of the lanthanide series of rare-earth elements, is injected into the body tissues, its insoluble hydroxide is formed. With the amounts of carrier used, it then behaves largely as a colloid and is mobilized to the reticuloendothelial system. When Lu^{177} is injected into the right superior mammary gland of dogs, it concentrates in the regional lymph nodes within a few hours. Its ionizing radiation is confined largely to these nodes. The radiation characteristics of this radioisotope indicate that no appreciable irradiation of other organs occurs. The concentration and dispersion of Lu^{177} throughout a lymph node is at least as satisfactory as the concentration and dispersion of colloidal Au^{198}. The distribution observed with tracer doses and the dosimetric comparison of Lu^{177} with other isotopes in medical use have suggested further studies of tissue damage by large doses. (auth)

9982

THERAPEUTIC USE OF ARTIFICIAL RADIOISOTOPES. Paul F. Hahn, ed. New York, John Wiley & Sons, Inc., 1956. 414p. London, Chapman & Hall, Ltd.

The therapeutic uses of artificial radioisotopes are reviewed. (C.H.)

9983

FORTSCHRITTE DER GEBURTSHILFE UND GYNAKOLOGIE. III. DIE RADIOAKTIVEN ISOTOPE IN DER GEBURTSHILFE UND GYANAKOLOGIE. (PROGRESS OF OBSTETRICS AND GYNECOLOGY. II. RADIOACTIVE ISOTOPES IN OBSTETRICS AND GYNECOLOGY). J. Becker and K. E. Scheer. New York, S. Karger, 1956. 122p. (In German)

9984

A SEX DIFFERENCE IN THE RESPONSE TO TITRATED IRRADIATION THERAPY (^{32}P) OF PATIENTS WITH CHRONIC GRANULOCYTIC LEUKAEMIA. William H. Crosby, Oscar L. Sapp, and Hjalmar Anderson, Jr. (Walter Reed Army Hospital, Washington, D. C.). Brit. J. Haematol. 2, 317-20(1956) July.

9985

POSSIBLE USE OF THE NEUTRON CAPTURING ISOTOPE $LITHIUM^6$ IN THE RADIATION THERAPY OF BRAIN TUMORS. Alfred J. Luessenhop, William H. Sweet, and Janette Robinson (Harvard Medical School and Massachusetts General Hospital, Boston). Am. J. Roentgenol. Radium Therapy Nuclear Med. 76, 376-92(1956) Aug.

9986

EFFECT OF PERITUMORAL TISSUE INFILTRATION WITH RADIOACTIVE YTTRIUM ON GROWTH AND SPREAD OF MALIGNANT CELLS. Horace Goldie and Harold D. West (Meharry Medical Coll., Nashville, Tenn.). Cancer Research 16, 484-9(1956) July.

A standard dose (0.2 mc) of Y^{90} was injected in eight or ten fractions into peritumoral subcutaneous tissue of mice bearing Sarcoma 180 or Sarcoma 37 on the abdomen, leg, or scalp. Twelve to 48 hours after tissue infiltration, autoradiographs and Geiger counts were taken. Tumor tissue showed a consistently higher level of radioactivity than

adjacent muscle and the liver; radioactivity was low in the spleen and insignificant in other organs. Requisite numbers of sarcoma cells were inoculated subcutaneously into the abdominal wall or into the scalp. One to 5 days later, the tissue surrounding the site of inoculation was infiltrated with Y^{90}. It was found that in the majority of mice treated with doses of 0.2 mc or higher 2 days after inoculation, the tumor growth was scanty or absent, and the survival was longer as compared with untreated controls. It is concluded that peritoneal treatment of large tumors affects consistently only their periphery, but malignant cells scattered in normal tissue can be easily reached and inactivated by infiltrated Y^{90} before the tumor becomes organized. It is suggested that, in clinical therapy, infiltration of the tumor bed and tumor periphery with Y^{90} may arrest the peripheral growth of the tumor and may prevent the spread into normal tissue of scattered malignant cells from the tumor or of malignant cells spilled during surgical intervention. (auth)

TOXICOLOGY STUDIES

9987 CWLR-2053
Chemical Warfare Labs., Army Chemical Center, Md.
TOXICITY OF VAPORS IN THE PRESENCE OF AEROSOL CARRIERS. V. Alexander Gordieyeff. Aug. 17, 1956. 70p.

This paper is the final part of three studies on the interaction mechanism between vapors and airborne particles. It gives the results of toxicological experiments performed to test the Dautrebande hypothesis that vapor sorption on inert, airborne, carrier aerosols possibly increase the toxicity of a vapor. The experimental setups (involving exposure chambers of the semistatic and the dynamic type) are described. Mortality curves for rats, mice, and hamsters are compared for vapors of acetone, cyanohydrin, mustard gas, Sarin, phosgene, and formaldehyde in the absence and presence of various carriers. The mortality data do not show any significant differences which could be ascribed to the synergistic action of the carriers. This result confirms the predictions based on the studied mechanism of sorption of vapors by various airborne carriers. The validity of these results is limited to acute inhalation toxicities of volatile substances sorbed on biologically inert aerosols. (CWLR Abst.)

9988 AEC-tr-2635
ARGUROA: "ARGENTIC PHOTODERMATITIS." R. Dalimier. Translated by K. S. Bevis from Monde Med., Paris. 45, 813-16(1935). 4p.

9989
STUDIES ON THE INFLUENCE OF SULFUR COMPOUNDS ON MOLYBDENUM TOXICITY IN RATS. Robert Van Reen and Mary Ann Williams (Johns Hopkins Univ., Baltimore). Arch. Biochem. Biophys. 63, 1-8(1956) July.

In a study of the influence of methionine, cystine, sodium thiosulfate, and sodium sulfate on molybdenum toxicity in rats, it was found that sulfur-containing compounds included in the toxic diet improved the enzymatic anomaly observed in molybdenum toxicity and improved growth. (F.S.)

9990
MECHANISM OF URANIUM POISONING. H. C. Hodge (Univ. of Rochester, N. Y.). Arch. Ind. Health 14, 43-7 (1956) July.

More is known about the toxicity of uranium than about the toxicity of any other element. Uranium in the body is highly toxic; providentially, it is hard to absorb into the body. Once absorbed, uranium is carried partly as a protein complex and partly as a bicarbonate complex. In the bone uranium is deposited principally on the surface of the mineral crystals by exchange with calcium. The kidney is the sole site of the characteristic histological injury. Uranium kills cells by blocking carbohydrate metabolism, apparently inhibiting specifically hexokinase in the cell surface. Finally, a tribute should be paid to the vigilant medical supervision of the Manhattan Project and the Atomic Energy Commission. This supervision has been so successful at all their installations that severe uranium poisoning has never occurred and mild uranium poisoning is so rare that it is practically unknown. (auth)

9991
INDUCED ACCUMULATION OF CITRATE IN THERAPY OF EXPERIMENTAL LEAD POISONING. Joan F. Fried, Marcia Rosenthal, and Jack Schubert (Argonne National Lab., Lemont, Ill.). Proc. Soc. Exptl. Biol. Med. 92, 331-3(1956) June.

9992
AUTORADIOGRAPHIC STUDY OF LOCALIZATION OF AURINTRICARBOXYLIC ACID IN EXPERIMENTAL BERYLLIUM POISONING. Arthur Lindenbaum and Hermann Lisco (Argonne National Lab., Lemont, Ill.). Proc. Soc. Exptl. Biol. Med. 92, 354-7(1956) June.

9993
THE EFFECTS OF CALCIUM DISODIUM ETHYLENEDIAMINE TETRAACETATE ON URANIUM POISONING IN RATS. R. Dagirmanjian, E. A. Maynard, and H. C. Hodge (Univ. of Rochester School of Medicine and Dentistry, N. Y.). J. Pharmacol. Exptl. Therap. 117, 20-8(1956) May.

TRACER APPLICATIONS

9994 HW-41422
Hanford Atomic Products Operation, Richland, Wash.
PHYSIOLOGICAL PARAMETERS FOR ASSESSING THE HAZARD OF EXPOSURE TO RUTHENIUM RADIOISOTOPES. R. C. Thompson, M. H. Weeks, O. L. Hollis, J. E. Ballou, and Willa D. Oakley. Mar. 1, 1956. 59p. Contract W-31-109-Eng-52. $9.30(ph OTS); $3.60(mf OTS).

Results are reported from a variety of studies on the absorption by various routes, the distribution, the excretion, and the long term retention of Ru^{106} in various tissues of the rat. Gastrointestinal absorption of Ru is much greater than previously assumed; the maximum permissible concentration of Ru^{106} in drinking water should be 4×10^{-3} μc/ml. (auth)

9995
THE MEASUREMENT OF NUCLEIC ACID TURNOVER IN RAT LIVER. Robert W. Swick, Arthur L. Koch, and Dorothy T. Handa (Argonne National Lab., Lemont, Ill. and Univ. of Chicago). Arch. Biochem. Biophys. 63, 226-42 (1956) July.

$C^{14}O_2$ was incorporated into the nucleic acids of rat liver by continuous isotope administration. Metabolic CO_2 enters the C-6 position of the purines without dilution. Glycine enters the C-4, C-5, and C-7 position without dilution. In young rats the new liver DNA synthesized per day is similar to the liver weight increase. The synthesis of one cell complement of DNA is associated with each mitosis and the rate of DNA renewal is rapid. In the adult rat, the average life span of the DNA molecule is estimated to be 150 days. (F.S.)

9996
PLASMA, TISSUE AND URINARY RADIOACTIVITY AFTER ORAL ADMINISTRATION OF ^{56}Co-LABELLED VITAMIN B_{12}. C. C. Booth and D. L. Mollin (Postgraduate Medical School of London). Brit. J. Haematol. 2, 223-36(1956) July.

9997
APPLICATION OF A SIMPLE ION EXCHANGE RESIN TECHNIQUE TO DETERMINATION OF SERUM OR PLASMA PROTEIN-BOUND I^{127} OR PROTEIN-BOUND I^{131}. Charles I. Slade (Univ. of California School of Medicine, San Francisco). J. Clin. Endocrinol. and Metabolism 16, 1122-5(1956) Aug.

9998
TECHNICAL CONSIDERATIONS IN I^{131} TRACER STUDIES. Robert E. Beck, John Kronsbein, and Arthur A. Hobbs, Jr. (Protestant Deaconess Hospital, Evansville, Ind.). J. Clin. Endocrinol. and Metabolism 16, 1102-8(1956) Aug.

Three hundred and sixty-four tracer studies performed on 302 patients are reported in order to demonstrate the comparative value of several I^{131} thyroidal uptake and urinary excretion techniques. The most accurate I^{131} method for the determination of thyroid function consists of counting with a bismuth-wall tube at a distance of 30 centimeters from the radiating source. Intravenous administration of the tracer dose eliminates technical inaccuracy arising from variable rates of absorption from the gastrointestinal tract. Counting intervals of four and eight hours offer advantages of greater diagnostic discrimination and convenience over the commonly employed 24-hour interval. (auth)

CHEMISTRY

9999 AERE-C/M-96
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
TRACER EXPERIMENTS ON TECHNETIUM. F. Morgan, M. L. Sizeland, and H. H. Willis. Dec. 21, 1950. 15p.

The results of experiments on the solvent extractability, behaviour with ion exchangers, and coprecipitation reactions of Tc^{99} are described. (auth)

10000 MCC-1023-TR-183
Ohio State Univ. Research Foundation, Columbus.
THERMODYNAMIC PROPERTIES OF THE SODIUM OXIDE–BORIC OXIDE SYSTEM. G. Grenier and D. White. Oct. 28, 1955. 12p. [For Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c].

From the heats of solution determined experimentally for pure boric oxide and varying mixtures of sodium borates, one of which corresponded to the composition of the pure sodium tetraborate, $Na_2O \cdot 2B_2O_3$, heats of solution of the other stable crystalline borates, sodium metaborate, sodium hexaborate, and sodium octaborate, were calculated on the assumption that the measured heats of solution of intermediate mixtures of two stable compounds are directly proportional to the amount of each compound present. Heats of reaction of oxide components to form crystalline borates were calculated from the difference between the heat of solution of the crystalline borate and that of the two pure components, sodium oxide and boric oxide. The heat of formation of the crystalline borates were obtained by adding the respective heat of reaction to the heat of formation of the two component oxides. (auth)

10001 NAVORD-1965
Naval Ordnance Test Station, Inyokern (China Lake), Calif.
FERROELECTRICS OF BARIUM TITANATE TYPE: A BIBLIOGRAPHY. Articles Appearing in Open Literature Only, with Abstracts [through June 30, 1951]. L. O. Anderson, comp. Apr. 22, 1952. 85p. (NOTS-535).

Abstracts are included of approximately 230 papers dealing with barium titanate and similar ferroelectrics. Theoretical and experimental studies of the basic physical properties of these materials are emphasized, but some references on this use are included. (auth)

10002 ORNL-2130
Oak Ridge National Lab., Tenn.
PROBLEMS PERTAINING TO THE DEHYDRATION OF SODIUM HYDROXIDE BY VOLATILIZATION OF WATER. G. P. Smith. Sept. 10, 1956. 11p. Contract W-7405-eng-26. $0.15(OTS).

Water, a ubiquitous contaminant of NaOH, has an effect on many reactions conducted in NaOH melts. Dehydration by volatilization at temperatures approaching 800°C is impractical because of self-dissociation, but very little has previously been published on dehydration at lower temperatures. The experiments described herein showed that volatilization of water from NaOH is exceptionally rapid in two widely separated temperature ranges, one in the neighborhood of 60 to 70°C and the other beginning a little below the melting point of the hydroxide. The high rate of water evaporation in the low-temperature range is attributed to melting of the monohydrate layer found at the surface of a hydroxide particle which had been exposed to a moist gas. Volatilization of H_2O from the fused hydroxide takes place most rapidly by formation of water-vapor bubbles, but pronounced superheating was found. This superheating was enhanced by well-known devices, such as application of a gas pressure over the melt, and is believed to be a consequence of the high surface tension of the melt. (auth)

10003 WADC-TR-56-188
Cincinnati. Univ. Applied Science Research Lab.
STUDIES OF THE CHEMICAL-PHYSICAL NATURE OF ADHESION. Philip E. Berghausen, Robert J. Good, and Walter Soller. July 1956. 156p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Contract AF33(616)-2824. (AD-97129).

It was discovered that the heat of immersion in water for a number of solids could be divided into two parts: an immediate heat and a slow heat; the latter had never been reported before. The slow heat was attributed to chemical reaction between the solid and the liquid, such as the formation of a carbon–oxygen surface complex in the case of graphite, or the hydration of the surface with relief of strain in the case of alumina. The separation of slow from immediate heat has made possible the more accurate measurement of the heat of immersion of various solids, including the measurement of the temperature coefficients. This has been carried out for alumina, silica gel, rutile and anatase. Heats of immersion have been measured for surfaces covered to various extents with films of stearic and perfluorodecanoic acids. In the latter case, a negative heat of immersion was observed at high coverage. A theory was developed for the indirect measurement of heat of immersion of substances such as polymers on which water forms non-zero contact angles. By this theory it was shown that the negative heat of immersion mentioned above is consistent with the high contact angle (180°) of water on a film of perfluorodecanoic acid. A glass diaphragm gage has been developed for use in measuring pressures in the range of 10 microns to 5 mm Hg. In study of the surface entropy of polar liquids, it was shown that the low temperature coefficients of the surface tension of hydrogen bonding liquids are due to the orientation of surface molecules. It was concluded that for liquids such as water, fatty acids, primary and secondary alcohols and amines, and HCN, the active hydrogens point inwards into the liquid phase. Tensile measurements of the adhesion of metal-ice-metal joints showed that the quantity being measured was generally the cohesive

strength of flawed ice. The effective adhesion was found to depend on the nature of the metal (e.g., aluminum vs. steel) even though the failures were all in the middle of the ice layer. The effective adhesion was found to depend strongly on the dissolved gases in the water: removal of air and replacement with helium (which is considerably less soluble in water than is air) led to a very marked increase in the strength of the joint. These results point to the conclusion that flaws caused by air coming out of solution may be the dominant factor in this adhesive system. (auth)

10004 WADC-TR-56-203

Pennsylvania State Univ., University Park. Coll. of Chemistry and Physics.

COORDINATION POLYMERS. [Period covered] December 1, 1954 to February 29, 1956. W. Conard Fernelius. Apr. 1956. 124p. Project No. 7340. Contract AF33(616)-2742.

The idea of producing polymers through coordination is presented, pertinent literature reviewed, and various possibilities of developing such polymers considered. Bis(β-diketone)-metal ion combinations were investigated from the standpoint of polymer formation. Several bis(β-diketones) were synthesized and shown by potentiometric titration to form metal chelates of stabilities comparable to the simple β-diketones. Three methods of chelate polymerization were investigated: reaction in aqueous solution, melt polymerization, and non-aqueous solution polymerization. The effect of reaction conditions and method of preparation on molecular weight were considered. All three methods of polymerization are applicable to a wide range of molecular weights. Method (i) seems to offer the most promise for molecular weights over 4000 to 6000, while method (ii) is more readily adaptable to lower molecular weights. The molecular weights obtained by method (iii) can be regulated by controlling reaction time and the source of metal. Copolymerization in chelate polymer systems is possible and products of intermediate properties are obtained. Marked changes in physical properties are observed when small amounts of tervalent metal ions are included in polymerizations of bivalent metal ions and bis(β-diketones). This behavior can be explained on the basis of branching and cross-linking. Both metal ion and ligand structure were found to have a marked effect on physical properties. Stability of the chelate polymers toward dilute acid and base was also investigated. In general, the polymers are stable toward dilute base and mineral acid. The infrared spectra of the bis(β-diketones) and their metal chelates were observed. The carbonyl absorption frequencies of the metal chelates were correlated with the approximate chelate stabilities. Infrared spectra of a series of beryllium-sebacoyldiacetophenonate polymers were also correlated with molecular weight. The viscosities of several benzene solutions of beryllium-sebacoyldiacetophenonate polymers were determined and compared with the viscosities of solutions of typical linear organic polymers. X-ray diffraction applied to a zinc-sebacoyldiacetophenonate fiber gave only diffuse scattering, indicating that the material was amorphous. None of the polymers prepared exhibited the Tyndall effect in benzene solution. Preliminary work has been done on the production of polymers by the polymerization of metal derivatives of unsaturated β-diketones. A few such β-diketones have been prepared as well as their beryllium and copper derivatives. Polymerization of these by free-radical initiators is indicated. The metal derivatives of bis(Schiff bases) prepared from aromatic diamines are difficult to prepare and lack solubility in common organic solvents. Similarly, the metal derivatives of dihydroxyquinones are almost impossible of preparation in pure form and are highly insoluble. Neither of these classes of compounds seems to offer any possibilities worth exploring. A few bis(o-hydroxyazo) compounds have been prepared for the purpose of studying their metal derivatives. Attempts to produce a truly inorganic polymer by the coordination of polyfunctional acids (anions) to complex cations have not been successful. The preparation of intermediates has proven to be difficult and no true polymer has yet been obtained. (auth)

10005 AEC-tr-2633

THE CATALYTIC REDUCTION OF CARBON DIOXIDE TO METHANE AND HIGHER HYDROCARBONS AT THE NORMAL PRESSURE. Franz Fischer, Th. Bahr, and A. Meusel. Translated by F. Hudswell from Brennstoff-Chem. 16, 466-9(1935). 9p.

Reduction of CO_2 to CH_4 is appreciable at Ru powder or Ru-asbestos contact catalysts at 100°C and up. Ru is superior to previously known contact catalysts for this reaction but is not immune to H_2S-poisoning. With Ru made alkaline with K_2CO_3 the reaction begins at 170°C and higher liquid hydrocarbons are formed. Alkali metal carbonates below K were less effective; Rb_2CO_3 was more effective. The formation of CO is an intermediate step. (T.R.H.)

10006 AERE-Lib/Trans-685

INVESTIGATIONS OF THE FACTORS WHICH DETERMINE THE REACTION OF SOIL. PART I. ON THE DETERMINATION OF THE ACIDIC OR BASIC PROPERTIES OF A SOIL. Niels Bjerrum and J. K. Gjaldbaek. PART II. ON THE REACTION OF SATURATED SOLUTIONS OF CALCIUM CARBONATE. Niels Bjerrum and J. K. Gjaldbaek. PART III. THE DIFFERENT FORMS OF MAGNESIUM CARBONATE AND ON THE REACTION OF SATURATED SOLUTIONS OF IT. J. K. Gjaldbaek. Translated by J. Rundo from K. Vet. Højsk. Aarsskr., 49-87(1919) and 245-96(1921). 76p.

10007

SOLUBILITY OF IRON IN FUSED MIXTURES OF LiCl–KCl and NaCl–KCl. V. P. Kochergin and G. I. Stolyarov. Zhur. Priklad. Khim. 29, 730-3(1956) May. (In Russian)

Investigations were made to reveal the mechanisms of iron solubility in melted electrolytes and the rate of iron solubility in fused salts of LiCl–KCl and NaCl–KCl. Results show that in transition from salt eutectics of LiCl–KCl to the easily melting mixture of NaCl–KCl, the rate of iron solubility is reduced. An increased rate of iron solubility with the increase of temperature in fused chlorides of alkali metals has been observed. An analytical method of determining iron solubility in a fused eutectic containing hydrogen is discussed. (R.V.J.)

10008

MOLECULAR GEOMETRY IN ENZYME ACTION. Daniel E. Koshland, Jr. (Brookhaven National Lab., Upton, N. Y.). J. Cellular Comp. Physiol. 47, Suppl. 1, 217-34(1956) May.

10009

THE HYDROLYSIS OF ESTERS OF SOME SUBSTITUTED BENZOIC ACIDS IN STRONGLY ACID AQUEOUS SOLUTIONS. Chester T. Chmiel and F. A. Long (Cornell Univ., Ithaca, N. Y.). J. Am. Chem. Soc. 78, 3326-30(1956) July 20.

The hydrolysis rates of esters of several substituted benzoic acids have been found to agree with the Zucker-Hammett hypothesis which predicts that rates of acid-catalyzed reactions of uncharged molecules should vary linearly with the concentration of hydrogen ion when there is a water molecule in the transition state but should vary with the h_0 acidity function if the transition state does not include water. For the following esters the rates vary linearly with C_{H^+}: methyl benzoate at 90° in aqueous perchloric acid from 1 to 4 M; α-glyceryl monobenzoate and monoanisoate at 90° in solutions of from 0.04 to 6 M aqueous perchloric acid; α-glyceryl esters of benzoic, anisic and 3,4,5-trimethoxy-

benzoic acids at 50 or 70° in aqueous sulfuric acid of from 1 to 10 M. In contrast, the hydrolysis rate of methyl mesitoate at 90° in aqueous solutions of from 1 to 6 M perchloric and sulfuric acids varies linearly with the h_0 acidity function, not with C_{H^+}. Since the unhindered esters undoubtedly hydrolyze by the A-2 mechanism with a rate-determining reaction of the conjugate acid of the ester and a water molecule, proportionality of rate and C_{H^+} is the expected result. Methyl mesitoate probably hydrolyzes by the A-1, "unimolecular" mechanism to give an acylium ion; this should lead to the observed proportionality between rate and h_0. (auth)

10010

THE BROMINE PENTAFLUORIDE–HYDROGEN FLUORIDE SYSTEM. SOLID-LIQUID EQUILIBRIA, VAPOR PRESSURES, MOLAR VOLUMES AND SPECIFIC CONDUCTANCES. Max T. Rogers, John L. Speirs, and Morton B. Panish (Michigan State Univ., East Lansing). J. Am. Chem. Soc. 78, 3288-9(1956) July 20.

Various physical properties of the bromine pentafluoride–hydrogen fluoride system have been investigated. The solid-liquid phase diagram shows a eutectic point at −85.61° and 95.2 mole per cent hydrogen fluoride. The vapor pressure-composition diagram shows large positive deviations from Raoult's law. The deviations from ideality become larger at higher temperatures, and at at 25°C there is probably an azeotrope with maximum vapor pressure. Average molar volumes observed are lower than calculated for an ideal solution, the contraction on mixing being 2 to 3%. The specific conductance of a carefully purified sample of bromine pentafluoride was 9.1×10^{-6} ohm^{-1} cm^{-1}. Conductances of bromine pentafluoride–hydrogen fluoride mixtures were studied over a range of temperatures and compositions. (auth)

10011

STUDIES OF CHLORINATION REACTIONS OF TITANIUM OXIDE. A. N. Zelikman and T. Segarchanu. (Moscow Inst. of Non Ferrous Metals and Gold). Zhur. Obshchei Khim. 26, 625-9(1956) Mar. (In Russian)

It is shown that in contrast to the TiO_2 reaction, the TiO chlorinates with considerable speed at 300° temperature, and at 400 to 700° the chlorination maximum reaches 50%. The chlorination reaction is as follows: $2TiO + 2\ Cl_2 = TiCl + TiO_2$. In presence of carbon at 500°, TiO chlorinates much faster than TiO_2 under the same conditions. (R.V.J.)

10012

FILTER-BOMB SAMPLING TECHNIQUE FOR PHASE EQUILIBRIA AT HIGH TEMPERATURE PRESSURE. R. M. Bidwell, W. R. Wykoff, and B. J. Thamer (Los Alamos Scientific Lab., N. Mex.). Nucleonics 14, No. 7, 66-72 (1956) July.

The filter-bomb sampling technique is versatile, simple and safe. In the course of fuel solution development for reactors it has been used with highly corrosive acids and oxidants at temperatures from 100 to 600°C. The present design of equipment is adequate for 20,000 psi. (W.L.H.)

10013

MECHANISM OF ACTION OF 5'-NUCLEOTIDASE. D. E. Koshland, Jr. and Sylvia Stein Springhorn (Brookhaven National Lab., Upton, N. Y.). J. Biol. Chem. 221, 469-76 (1956) July.

The point of bond rupture as a result of 5'-nucleotidase action has been studied during the hydrolysis of adenosine-5-phosphate in H_2O^{18}. The presence of a stoichiometric amount of O^{18} in the inorganic phosphate produced is consistent with a displacement mechanism involving an attack on the phosphorus atom. No appreciable exchange was observed on incubating H_2O^{18} with either KH_2PO_4 or adenylic acid. The very small exchanges observed on incubating adenosine-C^{14} with adenylic acid or $KH_2P^{32}O_4$ with adenylic acid agree with the calculations for the amount incorporated by reversal of the over-all reaction and indicate no appreciable exchange by a partial reaction. The exchange experiments establish that the enzyme intermediate must be short lived with respect to decomposition to products. (auth)

10014

THE UPTAKE AND ISOTOPIC ENRICHMENT OF LITHIUM BY YEAST. H. J. M. Bowen (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 2, 255-63(1956) June.

The K normally present in baker's yeast can be largely replaced by Li. Lithium-rich yeasts are not distinguished microscopically from normal yeasts; the Li can be removed very rapidly by incubating the yeast with K salts. If the yeast is incubated with mixtures of lithium and potassium, the Li/K ratio inside the yeast is always much smaller than in the medium. An empirical relation between the two ratios is in marked disagreement with the law of mass action. Lithium can be enriched in its lighter isotope when it is taken up by yeast. This isotope appears to enter and leave the yeast cell more readily than Li^7. It is suggested that biologically enriched Li^6 may be discovered in nature. (auth)

10015

THE Fe(II)–Tl(III) REACTION AT HIGH CHLORIDE CONCENTRATION. Frederick R. Duke and Bernard Bornong (Iowa State Coll., Ames). J. Phys. Chem. 60, 1015-16 (1956) July.

The reaction between Tl^{3+} and Fe^{2+} has shown to be retarded by the chloride. $Tl^{3+} + Fe^{2+} \rightleftharpoons Fe^{3+} + Tl^{2+}$ followed by the slow reaction $Tl^{2+} + Fe^{2+} \rightarrow Fe^{3+} + Tl^{+}$ does not associate with chloride sufficiently to increase the equilibrium of Tl^{2+}. The only alternative is to allow the formation of Tl^{2+} chloride complexes which have less stability than Tl^{3+} chloride complexes. (W.L.H.)

AEROSOLS

10016 CWLR-2051

Chemical Warfare Labs., Army Chemical Center, Md. ADSORPTION OF VAPORS ON SOLID AEROSOLS (DUSTS). V. Alexander Gordieyeff. Aug. 17, 1956. 59p.

Results are presented of the first part of a study on the mechanism of interaction of vapors and aerosols, and deals with adsorption of vapors on airborne porous dusts. The essential mechanism of adsorption by bulk dust and its airborne fraction is identical. The peculiarities of the aerosol state are responsible for the extremely fast rates of adsorption and desorption, differential sorbate transfer between particles of different sizes, tendency to a decreasing sorptivity as a decreasing particle volume decreases pore volume,cloud effects interfering with adsorption and causing an increase of sorptivity with an increased concentration of the airborne mass, and relatively low sorptivity and vapor retentivity in saturated atmospheres. Generally, airborne dusts may be regarded as poor carriers of volatile toxic substances. (CWLR Abst.)

10017 CWLR-2052

Chemical Warfare Labs., Army Chemical Center, Md. ABSORPTION OF VAPORS BY LIQUID AEROSOLS. V. Alexander Gordieyeff. Aug. 17, 1956. 53p.

Results are presented of the second part of the study on interaction of vapors and aerosols, i.e., absorption of vapors by airborne droplets. The absorption mechanism by airborne droplets does not differ significantly from that

by the stationary bulk of absorbent. The peculiarities of the aerosol state are responsible for extremely fast rates of absorption and desorption, differential sorbate transfer between particles of different sizes, differential growth of particles of different sizes, and cloud effects interfering frequently with the process of absorption. Airborne droplets may generally be regarded as poor carriers of volatile toxic vapors. (CWLR abst.)

Refer also to abstract 9987.

ANALYTICAL PROCEDURES

10018 AERE-C/R-498(Del.)
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
RADIO FREQUENCY METHODS FOR THE MEASUREMENT OF ELECTROLYTIC CONDUCTIVITY. L. Airey and J. Woodward. Apr. 1950. 16p.

The application of radio frequency techniques to conductometric titrations etc. has been described in the literature, the major advantage over the conventional methods being the avoidance of electrodes immersed in the solution. The two general principles designated for convenience as "inductive" and "capacitive" are considered and compared. The capacitive method is examined in some detail, theoretically and practically, and improvements extending the working range one hundred fold are described. As a laboratory instrument, the apparatus is suited to remote operation. Conductometric titrations in the range 10^{-3}M to 5M HCl may be carried out on solution volumes as low as 2 mls. Adjustment of solutions to neutrality and adjustment of concentrations to predetermined values are feasible on a semi-micro scale. Non aqueous solutions may be examined, absolute values of specific conductivity being determined if desired by comparison and interpolation. Using simple and easily fabricated polythene apparatus, acid solutions containing fluoride ions may be measured. Brief consideration is given to the possibilities of the method for monitoring or controlling solution concentrations. (auth)

10019 CC-1706
[Chicago. Univ.] Metallurgical Lab.
MISCELLANEOUS NOTES ON ANALYTICAL METHODS. H. L. Davis, comp. Feb. 29, 1944. Decl. Nov. 1, 1955. 80p. $0.50(OTS).

Miscellaneous procedures are presented for the analysis of U, U oxides, U fluorides, and U ores for metallic impurities. (C.W.H.)

10020 IGO-AM/S-43
Gt. Brit. Springfields Works, Springfields, Lancs, England.
DETERMINATION OF COMBINED NITROGEN IN MOLYBDENUM METAL (MODIFIED ALLEN METHOD). T. G. Clinton. July 18, 1956. 7p.

The metal is dissolved in hot concentrated sulfuric acid and oxidation to molybdic acid is completed by addition of hydrogen peroxide. An aliquot of the solution is steam distilled with excess sodium hydroxide. The ammonia in the distillate is determined absorptiometrically using sodium phenate/sodium hypochlorite reagent. The method is suitable for pure rod, sheet or powdered metal containing between 20 ppm and 0.5% combined nitrogen. At the 50 ppm level results show a negative bias of about 10%. At the 400 ppm level results are quantitative with a coefficient of variation of about ±4%. (auth)

10021 K-1295
Oak Ridge Gaseous Diffusion Plant, Tenn.
ON THE USE OF INFRA-RED FOR LOW CONCENTRATION CONTINUOUS FLUORINE ANALYSIS. D. M. Papke. Sept. 12, 1956. 20p. Contract W-7405-eng-26. $0.20 (OTS).

A prototype gas titration type fluorine analyzer utilizing an infrared instrument in place of a pressure sensitive device to determine changes in flow was constructed and tested. An increase in optical sensitivity was indicated by the tests, however, advent of the technique of Line Recorder Mass Spectrometer analysis made further investigations pointless unless an alternative approach is needed, in which case further investigation is definitely recommended. A hypothetical design calculation on an infrared fluorine analyzer is presented. (T.R.H.)

10022 KY-173
Union Carbide Nuclear Co. Paducah Plant, Ky.
DETERMINATION OF TRIVALENT CHROMIUM IN THE PRESENCE OF CHROMATE. R. W. Cline, R. E. Simmons, and W. R. Rossmassler. July 17, 1956. 6p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

A method is given for the determination of small amounts of Cr^{+3} in H_2O containing approximately 300 ppm chromate. The Cr^{+3} is separated from chromate by precipitating with NH_4OH using $Al(OH)_3$ as a carrier. The Cr^{+3} is then oxidized to chromate with Br_2 and determined spectrophotometrically. This method was developed for use in the range of 0 to 0.5 ppm Cr^{+3}; however, the range could be extended. Reproducibility is good. (auth)

10023 LA-1967
Los Alamos Scientific Lab., N. Mex.
THE COLORIMETRIC DETERMINATION OF TITANIUM IN URANIUM. A. L. Henicksman. Oct. 1955. 16p. Contract W-7405-eng-36. $0.20(OTS).

A method is described for the determination of Ti in U in the range of 0.3 to 1.0 percent Ti. The bulk of the U is removed by precipitation with H_2O_2 at pH 2, while the Ti is effectively held in solution with Versene. The color of the titanium peroxide complex in the resulting solution is measured at 400 millimicrons. For 96 known samples, the average recovery of Ti was 99.9 percent, with a standard deviation of 0.5 percent. V interferes seriously with the determination of Ti, but small amounts of Th, W and sulfate have no effect. (auth)

10024 LA-1995
Los Alamos Scientific Lab., N. Mex.
THE SPECTROPHOTOMETRIC DETERMINATION OF CERIUM IN PLUTONIUM. Maynard E. Smith. Jan. 1956. 20p. Contract W-7405-eng-36. $0.20(OTS).

A method is described for the determination of Ce in Pu alloys containing 3% Co. A separation of the Ce is made by oxidizing the Pu to the (VI) oxidation state with persulfate and precipitating the Ce as the fluoride using LaF_3 as a carrier. After conversion of the fluoride precipitate to the sulfate, the Ce is again oxidized with persulfate and the amount present determined by measuring the absorbance of the sulfate solution at 320 mμ. In small amounts, Mo, Ta, Fe, Zr, Nd, and Ru do not interfere with the determination. (auth)

10025 NP-6083
Stanford Research Inst., Menlo Park, Calif.
SURFACE ANALYSIS BY NUCLEAR TECHNIQUES. Interim Technical Report No. 1 [for] July 1, 1955 to July 31, 1956. L. Evan Bailey. Aug. 24, 1956. 34p. SRI Project No. SU-1430. Contract DA-04-200-ORD-440.

Techniques have been developed for using proton- and deuteron-induced nuclear reactions for the determination of the chemical composition of solid surfaces. Quantitative measurements of C, O, F, and Na concentrations have been made utilizing the nuclear reaction products from the $C^{12}(d,p)C^{13}$, $O^{16}(d,p)O^{17}$, $F^{19}(p,\alpha\gamma)O^{16}$, and $Na^{23}(d,p)Na^{24}$

reactions, respectively. With these techniques concentrations of 0.1% and less can be measured. A beam-current integrating circuit suitable for the measurement of short-lived activities has been devised and tested. Analyses in which nuclear reaction and elastic proton scattering techniques have been used are described. (auth)

10026

A TRITIATED WATER STANDARD. H. G. Rieck, I. T. Myers, and R. F. Palmer (General Electric Co., Richland, Wash.). Radiation Research 4, 451-66(1956) June.

A tritiated water sample has been prepared and its activity determined by three different independent methods. This sample is now in use as a standard. The error in the final activity is estimated to be 2%. Considerable care was taken throughout the standardization measurements in order to reduce isotope effects and the effects of T_2 adsorption on apparatus surfaces. (auth)

10027

SIMULTANEOUS DETERMINATION OF RADIOCHEMICAL MIXTURES. Alvin S. Blum (V. A. Hospital, Coral Gables, Fla.). Nucleonics 14, No. 7, 64-5(1956) July.

A simple method has been developed for counting body electrolytes, sodium and potassium, simultaneously. It can be applied to the resolution of mixtures of radiochemicals in an organic or biological situation. The method uses a single gamma-sensitive detector plus "mathematical resolution". (W.L.H.)

10028

DIFFERENTIATION OF Fe^{59} AND Cr^{51} IN MIXTURES. Raymond L. Libby and Katherine Hand (UCLA Medical Center, Los Angeles). J. Lab. Clin. Med. 48, 289-93(1956) Aug.

A simple lead absorber method has been described whereby any institution equipped with a scintillation detector may determine Fe^{59} and Cr^{51} radioactivities in mixtures. (auth)

10029

THE DIRECT ANALYSIS OF URANIUM–GALLIUM ALLOYS. G. W. C. Milner (Atomic Energy Research Establishment, Harwell, Berks, England). Analyst 81, 367-9(1956) June.

A volumetric procedure using EDTA is described for the analysis of U–Ga alloys. The U is reduced to U^{4+} by passing HCl solution through a lead reductor and is then determined by titrating with a standard ceric solution. (W.L.H.)

10030

DETERMINATION OF SMALL QUANTITIES OF NICKEL WITH α-FURILDIOXIME. C. G. Taylor (U. K. Atomic Energy Authority, Sellafield, Cumb., England). Analyst 81, 369-71(1956) June.

α-Furildioxime was used for colorimetric determinations of Ni in aqueous solutions. Interferences of Fe, Cr, and alkali-metal salts have been studied. The method has been used for the determination of Ni in Pu solutions. (W.L.H.)

10031

THE VOLUMETRIC DETERMINATION OF PLUTONIUM WITH ETHYLENEDIAMINETETRA-ACETIC ACID. G. W. C. Milner and J. L. Woodhead (Atomic Energy Research Establishment, Harwell, Berks, England). Analyst 81, 427-9(1956) July.

The complexing action of ethylenediaminetetraacetic acid has been employed for the volumetric determination of milligram quantities of Pu. After the Pu metal has been dissolved in HCl, the procedure consists in adding an excess of a standard ethylenediaminetetraacetic acid solution (0.01 M) and then weak NH_4OH to adjust the pH to a value of 2.5. The amount of ethylenediaminetetraacetic acid in excess of that required to form a complex with the Pu completely is next determined by titrating with a standard Th nitrate solution (0.01 M) to the color change of a mixed indicator consisting of alizarin red S and methylene blue. The amount of Pu is then calculated from the fact that this element forms a 1 to 1 complex with ethylenediaminetetraacetic acid. This procedure proved suitable for the determination of milligram amounts of Pu, the error being less than 1 per cent for quantities in the region of 10 mg. (auth)

10032

MICROFLOTATION METHOD OF HEAVY WATER ANALYSIS. I. P. Gragerov (Pisarzhevskiĭ Inst. of Physical Chemistry). Zhur. Anal. Khim. 11, 264-8(1956) June. (In Russian)

A modified microflotation method of heavy-water and heavy-oxygenous water analysis, enabling one to analyze 0.03 to 0.05 g. of water in 1.5 to 2 hour with the accuracy of 2% has been offered. (tr-auth)

10033

CHROMOTROPIC AZODYERS AS REAGENTS FOR TRIVALANT THALLIUM. I. M. Korenman, V. G. Potemkina, and L. S. Fedorova (Gor'kiĭ State Univ.). Zhur. Anal. Khim. 11, 307-9(1956) June. (In Russian)

Results established that chromotropic azodyers produce characteristic and sensitive reactions with Tl^{3+}. The salts of single valence Tl did not produce any reaction. The presence of Zr^{4+}, La^{3+}, Ce^{3+}, Al^{3+}, Cr^{+}, Fe^{3+}, Bi^{3+}, UO^{2+}, Be^{2+} did not interfere with the Tl^{3+} reactions. These colored reactions may be used for colorimetric determination of 1 to 10 γ Tl^{3+} in 1ml. solution with large excess of Al, Fe^{3}, Mg^{2+}, and Ca^{2+} salts. (tr-auth)

10034

LIQUID-LIQUID EXTRACTION PROCEDURES IN INORGANIC ANALYSIS. A REVIEW OF PRACTICAL APPLICATIONS WITH PARTICULAR REFERENCE TO METALLURGICAL ANALYSIS. T. S. West (Univ. of Birmingham, England). Metallurgia 54, 47-51(1956) July.

The growing complexity of modern materials has led to difficulties in their chemical analysis resulting from the increasing multiplicity of other substances accompanying the constituent to be determined. The development of new separation methods has made possible the continued use of classical analytical procedures in the face of increasing competition from physical methods, and in the present series of articles the author surveys liquid-liquid solvent extraction techniques in inorganic analysis, with particular reference to metallurgical analysis. In the sixth of the series, the author discusses the extraction of Group VIa, VIIa and the transition metals. (auth)

10035

RAPID POLAROGRAPHIC DETERMINATION OF URANIUM IN NONAQUEOUS SOLVENTS. D. J. Fisher and P. F. Thomason (Oak Ridge National Lab., Tenn.). Anal. Chem. 28, 1285-8(1956) Aug.

Rapid but precise polarographic methods have been developed for the determination of U in dissolved ores or inventory solutions, after its separation by solvent extraction from ions that interfere or from hazardous radioactivity. Optimum conditions are discussed for the separation and the subsequent polarographic analysis. Uranium is extracted with TBP–isopropyl ether, the organic extract is diluted with a solvent, such as glacial $H_2H_3O_2$, and supporting electrolyte is added. By use of standard polarographic apparatus well formed U waves are obtained in several nonaqueous media. The simplicity of the manipulations required is advantageous in work with radioactive samples. (auth)

10036

ION EXCHANGE–SPECTROPHOTOMETRIC DETERMINATION OF ALUMINUM. A. D. Horton and P. F. Thomason (Oak Ridge National Lab., Tenn.). Anal. Chem. 28, 1326-8 (1956) Aug.

Aluminum was separated from nearly all interfering metal ions by a strongly basic ion exchange resin. Aluminum in the effluent from the column was determined as the ammonium aurintricarboxylate lake at a wave length of 525 mμ with a relative standard deviation of 1.5% in the range from 5 to 50 γ of aluminum. The method is applicable generally to Cu–Al, U–Al, and Sn–Pb alloys, stainless steel, and Fe alloys. (auth)

10037

DETERMINATION OF CERIUM AND CHROMIUM IN CERIUM–CHROMIUM–URANIUM MIXTURES. Charles V. Banks and Jerome W. O'Laughlin (Iowa State Coll., Ames). Anal. Chem. 28, 1338-40(1956) Aug.

A procedure is described for the determination of Ce and Cr in Ce–U–Cr alloys. Chromium is determined (on an aliquot of the sample) titrimetrically after it has been preferentially oxidized to Cr^{6+} with fuming $HClO_4$. Cerium is not oxidized by fuming $HClO_4$ under the conditions used. Cerium and Cr are determined on another aliquot of the sample by titrating with Fe^{2+} after complete oxidation of Ce and Cr with peroxydisulfuric acid in the presence of Ag^+. A reason is suggested for the low results often obtained for Cr following the $HClO_4$ oxidation, and conditions are described for the quantitative oxidation of Cr with $HClO_4$. (auth)

10038

DRY COMBUSTION AND VOLUMETRIC DETERMINATION OF ISOTOPIC CARBON AND HYDROGEN IN ORGANIC COMPOUNDS. REMOVAL OF NITROGEN DIOXIDE, AND GAS TEMPERATURE CORRECTION FACTORS. David R. Christman, Joan E. Stuber, and Aksel A. Bothner-By (Brookhaven National Lab., Upton, N. Y.). Anal. Chem. 28, 1345-7 (1956) Aug.

Small amounts of NO_2 in the presence of excess O_2 will pass through a dry ice-cooled radiator trap at low pressures, making possible the freezing out of water before the removal of NO_2 by external means during the dry combustion of organic compounds. In applying a temperature correction to the gas pressure measurements of CO_2 and water by means of a two-liquid manometer, an empirical correction of greater magnitude (about 0.5% per degree) than that calculated by means of the gas law gives the most consistent results. (auth)

10039

FLUORESCENT X-RAY SPECTROGRAPHIC DETERMINATION OF URANIUM IN WATERS AND BRINES. W. L. Kehl and R. G. Russell (Gulf Research & Development Co., Pittsburgh, Penna.). Anal. Chem. 28, 1350-1(1956) Aug.

In a search for a method sensitive to small concentrations of U in H_2O and brine, a modification of a fluorometric method was adopted. The U is precipitated from the water or brine and the ashed precipitate is analyzed by fluorescent x-ray spectrography. When an internal standard is required, $Y(NO_3)_3$ is added. The sample holder of the Norelco x-ray spectrograph was modified to place the small precipitate samples in the most intense part of the beam from the molybdenum target x-ray tube. As little as 0.01 mg of U, equivalent to 0.01 ppm in a 1-liter water sample, can readily be measured, when the matrix contains no appreciable concentration of highly absorbing elements. The time for analysis is about 10 min per sample, when no internal standard is used, exclusive of the precipitation process. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

10040 ERDE-23/R/55

Gt. Brit. Explosives Research and Development Establishment, Waltham Abbey, Essex, England.

INFRA-RED SPECTRA OF PURE AND PARTIALLY DECOMPOSED METALLIC AZIDE CRYSTALS. P. W. J. Moore. Oct. 18, 1955. 49p.

Details are given of the previously known data on the structure of azides, and the infra-red absorption theory relative to crystalline azides. A more detailed account of the theory, as applied to the specific crystal lattices of potassium, sodium, and silver azides, is given in an appendix, and the experimental results may be compared with that theory. The work shows that the explosive property of the heavy metal azides is not connected with symmetry of the ion. It is also shown how infra-red spectral measurements may be applied to several of the problems associated with the sensitiveness of initiator materials. One of these is the effect of impurities in the individual crystals on the bulk sensitivity. Certain lattice impurities have been characterized by their infra-red spectrum. The work covers impurities placed in the crystal lattices of potassium and silver azide by internal decomposition arising from irradiation with ultra-violet light and x rays, at room and liquid oxygen temperatures. The infra-red spectral changes are discussed in relation to those which occur in their visible spectrum. It is concluded that certain specific impurities, such as F-centers, can be characterized, but evidence indicating the presence of crystal defects, such as internal cracks or dislocation lines was not observed. The use of the technique for studying the kinetics of decomposition or the stability of intermediates in the decomposition of azides is envisaged (auth)

10041

CRYSTALLOGRAPHIC STUDIES OF PEROVSKITE-LIKE COMPOUNDS. I. RARE EARTH ORTHOFERRITES AND $YFeO_3$, $YCrO_3$, AND $YAlO_3$. S. Geller and E. A. Wood (Bell Telephone Labs., Murray Hill, N. J.). Acta Cryst. 9, 563-8(1956) July.

The orthoferrites of the trivalent ions Gd, Eu, Sm, Nd, Pr, La, and Y and the compounds $YCrO_3$ and $YAlO_3$ are isostructural. They belong to space group D_{2h}^{16}-Pbnm with four distorted perovskite units in the true crystallographic cell. X-ray and morphological data on these crystals are given and the relationships among them are discussed. (auth)

10042

ICOSAHEDRAL COORDINATION NUMBER 12. D. S. Martin, Jr., R. E. Rundle, and S. A. Golden (Iowa State Coll., Ames). J. Chem. Phys. 24, 1114(1956) May.

It was determined by x-ray diffraction that in the compound $La_2(SO_4)_3 \cdot 9H_2O$, two sets of La^{3+} ions had coordination numbers of 9 and 12, respectively. An examination of the packing about the 12-coordination La^{3+} shows that it is approxi-approximately a regular icosahedron. (W.L.H.)

10043

ON FINE STRUCTURE BY ELECTRON INTERFERENCE. Horst Ehlers (Universität Hamburg, Germany). Z. Naturforsch. 11a, 368-72(1956) May. (In German)

10044

CRYSTALLOGRAPHIC DATA: URANYL OXALATE TRIHYDRATE, $UO_2C_2O_4.3H_2O$. Eugene Staritzky and Don T. Cromer (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 1353-4(1956) Aug. HENDECAHYDROGEN DIURANYL PENTAPHOSPHATE, $H_{11}(UO_2)_2(PO_4)_5$. Eugene Staritzky and Don T. Cromer (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 1354-5(1956) Aug. PENTAPOTASSIUM DIURANYL ENNEAFLUORIDE, $K_5(UO_2)_2F_9$. Eugene Staritzky, Don T. Cromer, and D. I. Walker (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 1355(1956) Aug.

DEUTERIUM AND DEUTERIUM COMPOUNDS

10045

ECONOMIC PROBLEMS IN THE PRODUCTION OF HEAVY

WATER BY DISTILLATION OF NATURAL WATER, USING THE THERMOELECTRIC CENTER. R. Casini. Energia nucleare (Milan) 3, 188-203(1956) June 15. (In Italian)

10046

THE DETERMINATION OF DEUTERIUM BY THE MASS-SPECTROMETRIC METHOD. A. MacDonald and R. I. Reed (Univ. of Glasgow). Analyst 81, 401-3(1956) July.

An attempt has been made to determine the deuterium content of some organic acids. Mass-spectrometric determination of the deuterium–hydrogen ratio has been employed with moderate success. The discrepancy between the results so obtained and those of a reference method is about 5% of the percentage abundance. (auth)

10047

THE KINETICS OF THE BASE-CATALYZED DEUTERIUM EXCHANGE OF DICHLOROFLUOROMETHANE IN AQUEOUS SOLUTION. Jack Hine and Norbert W. Burske (Georgia Inst. of Tech., Atlanta). J. Am. Chem. Soc. 78, 3337-9 (1956) July 20.

The alkaline hydrolysis and the base-catalyzed dueterium exchange of dichlorofluoromethane have been studied in aqueous solution at 0 and 20°. Kinetic equations are derived to take into account the complication of the deuterium exchange reaction by concomitant hydrolysis. The deuterium exchange is slower than that of chloroform, in agreement with other evidence that α-chlorine stabilizes carbanions better than α-fluorine does. Hydroxide ions remove protons from dichlorofluoromethane only about 50 to 70% faster than they remove deuterons. (auth)

FLUORINE AND FLUORINE COMPOUNDS

10048 NP-6070

Florida. Univ., Gainesville.

PREPARATION OF FLUORINE CONTAINING COMPOUNDS. Quarterly Technical Report [for] May 1, 1956 to July 31, 1956. H. C. Brown, R. D. Dresdner, J. A. Wethington, Jr., and J. A. Young. 49p. Contract Nonr-580(03).

Chemical reactions of $(CF_3)_2NCF_2COOH$, $CF_3N{=}CF_3C{=}CCF_3$, and pyrolysis of $CF_2OCF_2CF_2NC_2F_5$ and $(C_2F_5)_2O$ were studied. Several physical properties of $(C_2F_5)_2SF_4$ are tabulated. Fluorocarbon reactions with alkali metal vapors, fluorine exchange reactions, polymerization of tetrafluoroethylene, and other reactions of fluoroörganic compounds are described. (For preceding period see NP-5952.) (C.W.H.)

10049 AEC-tr-2632

IODINE HEPTAFLUORIDE. Otto Ruff and Rudolf Keim. Translated by I. A. Warheit from Z. anorg. u. allgem. Chem. 193, 176-86(1930). 10p.

On heating IF_5 and F_2 a reversible reaction takes place forming IF_7. A good method for its preparation is presented. The molecular weight was found to be 260; the analytical composition corresponds to the formula IF_7. IF_7 is colorless, melts at 5 to 6°C. At 4.5°C its vapor pressure corresponds to the formula $\log p = 8.6604 - 1602.6/T$ at one atmosphere. The specific weight of the liquid fluoride is about 2.75. Its chemical properties are like those of ClF_3, but as a rule less violent. The 6th and 7th atom of fluorine are given off easily and energetically; IF_5 is then formed giving off brown iodine which supports further fluorination. (auth)

10050

THE ENTROPY OF SOLUTION OR BROMINE IN PERFLUORO-n-HEPTANE. L. W. Reeves and J. H. Hildebrand (Univ. of California, Berkeley). J. Phys. Chem. 60, 949-52(1956) July.

The solubility of Br_2 in n-C_7F_{16} between −5 and 25° conforms closely with the equation: $\log_{10}x_2 = 1.5398 - 849.58/T$. x_2 denotes mole fraction of Br_2. At 25°, $x_2 = 0.0490$. The mole fraction of C_7F_{16} in Br_2 is of the order of 5×10^{-5}. The partial molal volume of Br_2 in C_7F_{16} at saturation is 72 ml., an enormous expansion over its molal volume, 51.5 cc. Its partial molal entropy of solution is 13.05 cal./deg., whereas the entropy of dilution according to Raoult's law would be only 6.0 e.u. The discrepancy can be accounted for by considering the entropy that would accompany (a) an expansion of the solvent by 20.5 ml., (b) the resultant increase in the free volume available to the Br_2, (c) a "Flory-Huggins" entropy for mixing at constant volume, and (d) a small decrease in molecular order of C_7F_{16} molecules adjacent to Br_2 molecules. (auth)

10051

INTER-COUPLING SYSTEM OF LITHIUM FLUORIDES AND BARIUM SILICATES. N. A. Bychkova and A. G. Bergman. (Rostov-on-Don State Univ.). Zhur. Obshchei Khim. 26, 639-51(1956) Mar. (In Russian)

Visual-polythermal method was used in investigations of crystallization curves for binary systems of LiF–Li_2SiO_3, $BaSiO_3$–Li_2SiO_3, LiF–BaF_2, and $BaSiO_3$–BaF_2 (with 55 to 67.5% BaF_2), and the surface crystallization of triple inter-coupling systems of Li, Ba//F, SiO_3. Results showed that the visual-polythermal method can be used effectively in studies of the silicate and silicate-salt systems. (R.V.J.)

GRAPHITE

10052 COO-137

Great Lakes Carbon Corp., Morton Grove, Ill.

[HIGH DENSITY GRAPHITE]. Quarterly Report [for] March, April, May 1953. L. H. Juel. Decl. June 11, 1956. 21p. Contract AT(11-1)-221. $4.80(ph OTS); $2.70(mf OTS).

The results of investigations on the effects of baking carbon bodies at superatmospheric pressures and on the use of an impregnation technique for densifying carbon and graphite bodies are given. Some work on the use of additives for increasing carbon residues from binding materials is also reported. (T.R.H.)

10053

C-AXIS ELECTRICAL CONDUCTIVITY OF GRAPHITE. W. Primak (Argonne National Lab., Lemont, Ill.). Phys. Rev. 103, 544-6(1956) Aug. 1.

Small crystals of natural graphite showing no evidence of twinning were found in a sample of marble from the Lead Hill mine (Ticonderoga, New York). They were isolated, handled very carefully to avoid deformation, and their c-axis conductivity determined. It was found to be about $2 \times 10^2(\text{ohm cm})^{-1}$, in accord with previous measurements of less perfect crystals. It is shown that much of the variability in the measurements of larger, less perfect crystals is caused by nonuniform current flow. However, evidence is adduced to indicate that the actual c-axis conductivity of natural graphite crystals does vary somewhat. (auth)

Refer also to abstract 10388.

LABORATORIES AND EQUIPMENT

10054 K-272

Carbide and Carbon Chemicals Corp. [K-25 Plant], Oak Ridge, Tenn.

A DEVICE FOR THE REMOVAL OF MERCURY VAPOR FROM THE EXHAUST OF VACUUM CLEANERS. W. D. Cline and J. A. Westbrook. Sept. 20, 1948. 12p. $3.30 (ph OTS); $2.40(mf OTS).

A packing of hopcalite placed inside the torpedo type

vacuum cleaner was found to remove Hg vapor from the influent air. Such a device may be used in Hg cleanups without toxic effects from the exhaust. The details of construction, test methods, and recommendations for operation are given. (auth)

10055

HEATING AND VENTILATING AT HARWELL G. M. Harbert (Atomic Energy Research Establishment, Harwell, Berks, England). Nuclear Power 1, 75-8(1956) June.

Various methods of heating laboratories at Harwell are discussed. Utilization of waste-heat from BEPO, the natural uranium, graphite moderated research reactor, to provide space heating and hot water is described in some detail and the limitations of the system are related. The trend of mechanical ventilation systems in radioactive laboratories is reviewed and features of some unusual systems are explained, including the use of glass ducts and the operation of axial-flow fans in series to provide high head and so increase the useful life of high-grade filters which, being active, present a disposal problem. (auth)

MOLECULAR STRUCTURE

10056 CCC-1024-TR-197

Callery Chemical Co., Penna.

MASS SPECTROMETRIC APPEARANCE POTENTIALS FOR POSITIVE ION FRAGMENTS FROM BORANE DERIVATIVES. R. W. Law and J. L. Margrave — P. M. Maginnity, ed. Aug. 13, 1956. 8p.

Mass spectrometer appearance potentials were determined for positive ions obtained from BF_3, BCl_3, $(CH_3)_3B$, $(C_2H_5)_3B$, $(CH_3O)_3B$, and $(CH_3O)_2BH$. The relative abundance of the fragments from the latter four compounds was measured. (auth)

RADIATION CHEMISTRY

10057 AERE-C/R-1575(5)

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SELECTED ABSTRACTS OF ATOMIC ENERGY PROJECT UNCLASSIFIED REPORT LITERATURE IN THE FIELD OF RADIATION CHEMISTRY and BIBLIOGRAPHY OF THE PUBLISHED LITERATURE. (Papers Noted up to May 1956). PART 5. BIOCHEMISTRY AND RADIOBIOLOGY (EXCLUDING ANIMAL STUDIES). R. W. Clarke, comp. May 1956. 93p.

Brief abstracts are presented of selected American, Canadian, and British unclassified and declassified report literature up to May 1956 covering the effects of radiation on chemical and biochemical systems. The titles of published literature references from 1900 to May 1956 are included. Author and subject indexes are provided. (C.H.)

10058 AERE-NP/R-1982

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A SEARCH FOR THE EMISSION OF HIGH ENERGY γ-RADIATION FROM A PREPARATION OF Ac^{227}. J. F. Turner. Apr. 1, 1955. Decl. with amendments Jan. 26, 1956. 13p. (AERE-NP/R-1611(Rev.)).

The γ-ray emission of a preparation of Ac^{227} has been studied by observation of the secondary electron spectrum ejected from a Pb radiator, in a thin lens β-spectrometer with a proportional scintillator detector. Evidence for very low intensity γ rays of energy ~1.8, 2.5 and 3.5 Mev has been obtained, the time dependence of their intensities giving some guidance in their allocation. Evidence for a previously unreported γ ray of energy 1.11 Mev has also been obtained. (auth)

10059 PB-121303

Massachusetts Inst. of Tech., Cambridge.

FUNDAMENTAL PHYSICAL AND BIOCHEMICAL CHANGES WHICH OCCUR AS A RESULT OF RADIATION TREATMENT RESULTING IN MODIFICATIONS OF FLAVOR; COLOR, AND TEXTURE. Report No. 7 (Termination) [for] April 1, 1954—August 31, 1955. B. E. Proctor. 75p. Project No. 7-84-01-002. Contract DA44-109-qm-1744.

Data are presented from studies on the effects of cathode rays on aqueous solutions of ascorbic acid, oxalic acid, saturated and unsaturated carbonyl compounds in frozen orange juice concentrate, and amino acids. Procedures are described for the paper electrophoresis of casein and for the gravimetric measurement of carbon dioxide in gaseous and/or liquid phase. Apparatus are described for the rapid study of paper partition chromatography and for the separation of irradiated ascorbic acid solution into liquid and solid components. (32 references) (C.H.)

10060 UCRL-3422

California. Univ., Berkeley. Radiation Lab.

RADIATION INDUCED REACTIONS IN NONAQUEOUS SOLUTIONS (thesis). Laddie Ray Griffith. July 1956. 82p. Contract W-7405-eng-48. $13.80(ph OTS); $4.80(mf OTS).

The photoinduced disappearance of 1,1-diphenyl-2-picryl-hydrazyl, DPPH, in solution in several organic liquids was studied. Solutions of DPPH in cyclohexane, benzene, toluene, chlorobenzene and bromobenzene were irradiated with ultraviolet light of wave length 3126 to 3130 A. The initial rates of the disappearance of DPPH were studied spectrophotometrically and were found to be nearly independent of the amount of light absorbed by DPPH except for DPPH in cyclohexane. The rates were, however, proportional to the amount of light absorbed by the solvent. The results indicate that the reaction is one of short-lived excited species of the solvent molecules in benzene, toluene, chlorobenzene, and bromobenzene. Furthermore, the excited species responsible for the reaction is the lowest triplet state of the solvent molecule. A reaction of free radicals produced by the photodissociation of bromobenzene probably contributes to the rate of disappearance of DPPH in bromobenzene. Reactions of excited singlet states would not be observed in the DPPH concentration range studied because the lifetimes of the excited singlet states of these molecules are short compared with the time between collisions of these excited states with DPPH. Investigators using the rate of disappearance of DPPH as a free-radical counting technique in radiation chemistry must consider that DPPH also reacts with at least some of the excited species present in the irradiated solutions. (auth)

10061

CHEMICAL EFFECTS OF (n,2n) ACTIVATION OF IODINE IN ALKYL IODIDES. Charles E. McCauley, George J. Hilsdorf, Paul R. Geissler, and Robert H. Schuler (St. Peter's Coll., Jersey City, N. J. and Brookhaven National, Lab., Upton, N. Y.). J. Am. Chem. Soc. 78, 3246-52(1956) July 20.

The distribution of radioactive material between organic and inorganic products following the $I^{127}(n,2n)I^{126}$ activation of I_2 by fast neutrons has been studied in both liquid and solid ethyl, n-propyl, isopropyl, n-butyl and sec-butyl iodides. The total organic retention has been found in all cases to be very similar to that found for (n,γ) activation. For each of the above materials, the distribution of I^{126} activity among the various alkyl iodides has been studied using carrier fractionation methods. In the case of ethyl iodide the product distribution observed for (n,2n) activation has been found to be very similar to that for (n,γ)

activation. It is evident that the ultimate chemical fate of the radioactive nucleus is not dependent on the initial energy of the recoiling atom or on other variations which might be expected to result from the different nuclear processes. For all iodides, the activity is distributed among a number of components with the major fraction appearing in the parent material. The activity from solid n-propyl and n-butyl iodide is found to a considerable extent in the corresponding secondary iodide although in the case of the solid secondary iodides very little activity appears in the isomeric primary iodides. In general, products appear to be formed by reactions of the activated atom both in the epithermal region and, immediately after thermalization, with the radicals produced in the wake of the recoiling particle. (auth)

10062

RADIATION RESEARCH IN BRITAIN. TUBE INVESTMENTS' NEW FACILITIES. Atomics 7, 211-14(1956) June.

Facilities and equipment are described which are located in an industrial establishment engaged in utilizing radiation to produce changes in the physical and chemical properties of materials. (C.H.)

10063

RADIOCHEMICAL DECOMPOSITION OF HYDRAZINE IN AQUEOUS SOLUTION. Marc Ledfort and Moise Haissinsky (Institut du Radium, Paris). J. chim. phys. 53, 527-35 (1956) June. (In French)

10064

RADIOLYTIC REACTIONS IN NEUTRON-IRRADIATED BROMOBENZENE. Miriam Milman and P. F. D. Shaw (Clarendon, Oxford, England). J. Chem. Soc., 2101-9(1956) July.

Factors affecting the distribution of the isotopes Br^{80}, Br^{80*}, and Br^{82} among the compounds produced in neutron-irradiated bromobenzene have been investigated. A radiation-induced exchange between bromobenzene and Br atoms produced by radiolysis is largely responsible for the greater retention of the longer-lived isotopes, the exchanged atoms occupying the same positions in the benzene ring as the original atoms. The chief cause of the variable results obtained previously is probably the presence of water in the bromobenzene, which under the influence of radiation reacts to give phenolic products which with elementary radio-bromine then give other organic compounds. (auth)

10065

PRODUCING CHEMICALS WITH REACTOR RADIATIONS. P. Harteck and S. Dondes (Rensselaer Polytechnic Inst., Troy, N. Y.). Nucleonics 14, No. 7, 22-5(1956) July.

Nitrogen and O_2 were used to form NO_2 and NO. Yields of these compounds indicate possible commercial usefulness. Burnup of one mole of U^{235} will fix 70 to 80 tons of N_2 as NO_2. (W.L.H.)

10066

MECHANISM FOR THE REDUCTION OF CERIC ION BY THALLOUS ION INDUCED BY COBALT-60 GAMMA RADIATION. Thomas J. Sworski (Oak Ridge National Lab., Tenn.). Radiation Research 4, 483-92(1956) June.

A mechanism has been presented for the radiation-induced reduction of ceric ion by thallous ion in 0.8 N sulfuric acid. In mixtures of ceric and thallous ions, the initial $G(Ce^{+++})$ is shown to be equal to $2G_{H_2O_2} + G_H + G_{OH}$. In ceric ion solutions, OH radical normally oxidizes cerous ion to ceric ion. When thallous ion is present, however, OH radical causes the reduction of ceric ion to cerous ion. This difference is due to the oxidation of thallous ion by OH radical to form thallium (II) ion which can reduce ceric ion with concomitant formation of thallic ion. $G(Tl^{+++})$ is thus equal to G_{OH}. (auth)

10067

X-IRRADIATION OF L-MALIC ACID IN AQUEOUS SOLUTIONS. F. K. Putney and A. W. Pratt (National Cancer Inst., Bethesda, Md.). Radiation Research 5, 134-45(1956) Aug.

The results obtained in the study of the radiochemical decomposition of malate in oxygenated, aqueous solutions at a pH of 7.3 indicate that practically no disruption of the basic four-carbon structure of malate occurs and that only two primary products—oxalacetate and α-hydroxy-β-keto-succinate—are formed in the decomposition reactions. Formation of these compounds occurs only in the presence of dissolved molecular oxygen, and the data indicate that no chain reaction is involved in the decomposition reaction. The paper includes a discussion of the radiochemical reactions which are thought to be the mechanism for formation of these compounds. The effects of varying oxygen concentration on the malate decomposition reactions are discussed. (auth)

Refer also to abstracts 9918 and 10636.

RADIATION EFFECTS

10068 TID-7515(Pt. 1)

Division of Reactor Development, AEC.

PAPERS PREPARED FOR RADIATION EFFECTS REVIEW MEETING, CONGRESS HOTEL, CHICAGO, JULY 31–AUGUST 1, 1956. Aug. 1956. 49p. $0.35(OTS).

Electrical resistivity, radiation annealing of Cu, Ni, and graphite, Young's modulus in Cu and threshold displacement of Ni are the objects of this study with high energy electrons at low temperatures. Also included are reports of experiments on radiolysis and pyrolysis of terphenyls and polyphenyls. Radiation damage to some components of the MTR is also discussed. (T.R.H.)

10069

ACTION OF Co^{60} RADIATION ON γ-HEXACHLOROCYCLOHEXANE AND CONSIDERATIONS ON THE RADIOSENSITIVITY. Jules Duchesne, Andre Monfils, and Joseph Depireux. Compt. rend. 243, 259-61(1956) July 16. (In French)

10070

PRIMARY ACTION OF X-RAYS ON LYSOZYME. Antonio Caputo and Klaus Dose (Max Planck Inst. fur Biophysik, Frankfurt, Germany). Nature 178, 209-10(1956) July 28.

10071

ON CERTAIN CHARACTERISTICS OF THE RADIOCHEMICAL POLYMERIZATION OF ACRYLONITRILE. A. Prevot-Bernas and J. Sebban- Danon. J. chim. phys. 53, 418-21(1956) May. (In French)

In the case of polymerization initiated by γ rays, an attempt was made to determine exactly the law relating the speed of polymerization to the radiation intensity for different degrees of advancement of the reaction. The transfer constant of acrylonitrile was also estimated. (tr-auth)

10072

ON THE OXIDATION OF FERROUS IRON IN SULFURIC ACID SOLUTION UNDER OXYGEN PRESSURE BY Co^{60} γ RADIATION. H. Le Bail and J. Sutton. J. chim. phys. 53, 430-2(1956) May. (In French)

Solutions of Mohr salts 2×10^{-2}M in 5N sulfuric acid were irradiated with Co^{60} γ rays under oxygen pressures of 6 and 14 atmospheres. The yield, G, the number of ferric ions produced by 100 ev absorbed in the solutions does not differ from that found for 10^{-3}M Mohr salts solutions in 0.8N sulfuric acid in equilibrium with air, but in the presence of benzene or metals, the yield G increases in variable proportions. (tr-auth)

10073
ON THE POLYMERIZATION OF VINYL CHLORIDE INITIATED BY γ RAYS. Adolphe Chapiro (Laboratoire de Chimie Physique de la Faculte des Sciences, Paris). J. chim. phys. 53, 512-14(1956) June. (In French)

10074
IRRADIATED POLYTHENE. Atomics 7, 261(1956) July.

RARE EARTHS AND RARE-EARTH COMPOUNDS

10075 ISC-744
Ames Lab., Ames, Iowa.
PREPARATION OF YTTRIUM METAL BY REDUCTION OF YTTERIUM TRIFLUORIDE WITH CALCIUM. O. N. Carlson, F. A. Schmidt, and F. H. Spedding. July 17, 1956. 22p. Contract W-7405-eng-82. $0.25(OTS).

The preparation of Y metal by the reduction of YF_3 with Ca is described. Alternate methods employing the formation of low melting Y–Zn or Y–Mg intermediate alloy are evaluated and data on chemical and microscopic purity of the resulting metal are presented. (auth)

10076 NP-6073
University of Southern Calif., Los Angeles.
A SURVEY OF THE LITERATURE CONCERNING THE RARE-EARTH HYDRIDES. Technical Report No. I [on] STUDIES OF THE RARE-EARTH HYDRIDES. James C. Warf and William L. Korst. June 30, 1956. 186p. Project NR 356-290. Contract Nonr-228(03).

10077 NP-6074
University of Southern Calif., Los Angeles.
PRESSURE-TEMPERATURE-COMPOSITION STUDIES OF THE LANTHANUM-, CERIUM-, PRASEODYMIUM-, NEODYMIUM-, SAMARIUM-, AND YTTERBIUM–HYDROGEN SYSTEMS. EXPERIMENTAL. Technical Report No. III [on] STUDIES OF THE RARE-EARTH HYDRIDES. James C. Warf and William L. Korst. June 30, 1956. 25p. Project NR 356-290. Contract Nonr-228(03).

10078 NP-6075
University of Southern Calif., Los Angeles.
PRESSURE-TEMPERATURE-COMPOSITION STUDIES OF THE LANTHANUM–, CERIUM–, PRASEODYMIUM–, NEODYMIUM–, SAMARIUM–, AND YTTERBIUM–HYDROGEN SYSTEMS. RESULTS. Technical Report No. IV [on] STUDIES OF THE RARE-EARTH HYDRIDES. James C. Warf and William L. Korst. June 30, 1956. 44p. Project NR 356-290. Contract Nonr-228(03).

10079 NP-6076
University of Southern Calif., Los Angeles.
CRYSTAL STRUCTURE OF THE RARE-EARTH METALS. Technical Report No. VII [on] STUDIES OF THE RARE-EARTH HYDRIDES. James C. Warf and William L. Korst. June 30, 1956. 28p. Project NR 356-290. Contract Nonr-228(03).

10080 NP-6077
University of Southern Calif., Los Angeles.
CRYSTAL STRUCTURE OF THE RARE-EARTH HYDRIDES. X-RAY DIFFRACTION BY RARE-EARTH HYDRIDE AMALGAMS. Technical Report No. VIII [on] STUDIES OF THE RARE-EARTH HYDRIDES. James C. Warf and William L. Korst. June 30, 1956. 47p. Project NR 356-290. Contract Nonr-228(03).

10081 NP-6078
University of Southern Calif., Los Angeles.
LANTHANUM MONOXIDE. Technical Report No. IX [on] STUDIES OF THE RARE-EARTH HYDRIDES. James C. Warf and William L. Korst. June 30, 1956. 7p. Project NR 356-290. Contract Nonr-228(03).

10082 NP-6079
University of Southern Calif., Los Angeles.
DISCUSSION AND SUMMARY. Technical Report No. X [on] STUDIES OF THE RARE-EARTH HYDRIDES. James C. Warf and William L. Korst. June 30, 1956. 6p. Project NR 356-290. Contract Nonr-228(03).

10083 ORINS-12
Oak Ridge Inst. of Nuclear Studies, Inc., Tenn.
RARE EARTHS IN BIOCHEMICAL AND MEDICAL RESEARCH: A CONFERENCE SPONSORED BY THE MEDICAL DIVISION, OAK RIDGE INSTITUTE OF NUCLEAR STUDIES, OCTOBER 1955. Granvil C. Kyker and Elizabeth B. Anderson, eds. 476p. Contract AT(40-1)-GEN-33. $2.20(OTS).

The chemistry of rare earth elements and compounds is reviewed. Procedures used in the production of rare earth radioisotopes are described. Data are presented on the tissue distribution of various rare-earth elements and compounds in laboratory and domestic animals. Pharmacological, biochemical, and metabolic considerations for the internal administration of these elements are discussed. Possible diagnostic and therapeutic applications of rare earth radioisotopes and associated dosimetry problems are considered. (299 references.) (C.H.)

SEPARATION PROCEDURES

10084 AERE-C/M-222
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE USE OF ADSORPTION COLUMNS FOR EFFECTING PRECIPITATION SEPARATIONS. E. Hesford. Aug. 1954. 7p.

The use of a bed of adsorbent, pre-treated with basic precipitants, to effect precipitation separation of cations is described. The technique is analogous to that employing anion exchanger beds, described elsewhere. (auth)

10085 DOW-147
Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] JULY–AUGUST 1956. Research Dept. R. H. Bailes. Sept. 1, 1956. 28p. Contract AT-30-1-GEN-236. $4.80(ph OTS); $2.70(mf OTS).

Investigations of the possibility of production of high grade U products directly from the solvent extraction process streams, of methods for decreasing solvent entrainment in extraction of heavy slurries, and of the preparation and testing of new types of solvents are presented. (auth)

10086 ORNL-1963
Oak Ridge National Lab., Tenn.
DESIGN OF AN AMINE EXTRACTION DEMONSTRATION PLANT. B. B. Klima, H. M. McLeod, Jr., A. D. Ryon, and R. R. Wiethaup—K. O. Johnsson, ed. Sept. 8, 1955. Decl. Jan. 10, 1956. 44p. Contract W-7405-eng-26.

The design of an amine extraction demonstration plant, along with installation costs, recovery costs, and operating costs are presented. (T.R.H.)

10087
CHROMATOGRAPHIC SEPARATION OF Cs^{137} FROM Rb–Cs BY SELECTIVE EXTRACTION ON CELLULOSE. J. Fouarge and G. Duyckaerts (Univ. of Liege, Belgium). Anal. Chim. Acta 14, 527-37(1956) June. (In French)

A search for a good method of separating Rb–Cs in micro quantities by chromatography on cellulose has revealed that only with a phenolic eluant (equilibrated with H_2O or 2N HCl) can a specially good separation be easily obtained. This separation remains quite effective from

quantities of a few milligrams to "tracer" amounts, and a selective separation of fission Cs^{137} "carrier free", directly from a nitric solution of irradiated uranium was obtained. (auth)

10088

STUDIES IN THE RECOVERY OF URANIUM FROM CARBONATE LEACH LIQUORS. PART II. AN ANION EXCHANGE PROCESS. Jagdish Shankar, D. V. Bhatnagar, and T. K. S. Murthy (Atomic Energy Establishment, Bombay). J. Sci. Ind. Research (India) 15B, 299-305(1956) June.

An ion exchange process for the recovery and concentration of uranium from dilute solutions containing free sodium carbonate, employing a strongly basic resin, Amberlite IRA-400, is described. It has been found that uranium uptake by the resin depends on the feed composition. When 1.0M sodium nitrate solution containing sodium carbonate was used for eluting uranium from the resin bed, the concentration of uranium in the eluate was of the order of 25 g/litre. Certain anions like vanadate, phosphate, aluminate, etc., which are likely to be present in the plant leach liquors have been observed to pass out in the effluent during the adsorption of uranium from a 5 per cent sodium carbonate solution. The recovery and purification of uranium from nitrate eluate could be achieved by ether extraction of uranyl nitrate. On the basis of studies with carbonate leach liquors obtained from a low grade Indian ore, a flow sheet for the recovery and purification of uranium has been suggested. (auth)

10089

SEPARATION OF NIOBIUM, TANTALUM AND TITANIUM. F. V. Zaĭkovskiĭ (All Union Inst. of Minerals). Zhur. Anal. Khim. 11, 269-77(1956) June. (In Russian)

Phase distribution of Nb, Ta, and Ti pyrocatechols have been studied in various conditions and a method of quantitative separation of elements has been offered. Titanium and Ta are separated from Nb at pH 3. Titanium is separated from Ta at re-extraction of 5% sulfuric acid. After separation of Ti and Ta, Nb is extracted from oxalate solution in the form of pyrocatechinate at pH 7. The accuracy order is ± 10%. Other elements (Zr, Sn, Pb, etc.) cannot be extracted in the form of pyrocatechnols. (tr-auth)

10090

SEPARATION OF Mg, Al, Cr, Mn, Fe, Ni AND Cu BY ION EXCHANGE METHOD. D. I. Ryabchikov and V. F. Osipova (Bernadskii Inst. of Geochemistry and Analytical Chemistry). Zhur. Anal. Khim. 11, 278-85(1956) June. (In Russian)

Copper separation from Al can be easily achieved by transformation of these minerals into different ion forms. In interaction with thiosulfate only Cu transforms into a complex anion $[Cu(S_2O_3)_2]^{3-}$, while in ammonia media Cu and Al change into various forms of complex ions $[Cu(NH_3)_4]^{2+}$ and $[APO_2]^-$. Such transformation enables one to separate Cu, Al, and Mg. After the Cu and Al in complex anions are separated, the remaining Mg on the resin column after the desorption by acid may be determined by the usual method. Separation of Fe and Cr in the presence of rhodanide only Cr transforms into a stable form of complex anion $[Cr(SCN)_6]^{-3}$ while Fe remains a simple cation and is retained by an active group of resins. In interactions of these metals with salts of pyrophosphoric acid an opposite reaction takes place. The same method may be applied for separation of Cr from Ni and the separation of ternary and quaternary compounds of the above metals. (R.V.J.)

10091

COLLOIDAL METHOD FOR CONCENTRATION OF CARBONACEOUS MATTER FROM ROCKS. Maurice Deul (U. S. Geological Survey, Washington, D. C.). Bull. Am. Assoc. Petroleum Geol. 40, 909-17(1956) May.

A technique is described by which organic matter can be separated and concentrated from carbonaceous rocks by physical means. Ball-mill grinding to colloidal sizes is carried out in a mixture of water and kerosene. Separation of such fine-sized particles is possible because two colloidal systems are formed, an organosol of organic material in kerosene and a hydrosol of mineral matter in water. The colloidal systems are isolated, the suspending media removed, and organic and mineral concentrates collected. Analytical data for ash, carbon, and hydrogen are given for the separates from the fractionation of three carbonaceous shales, a carbonaceous sandstone, and an argillite. Shales and sandstone with carbon contents ranging from 12% to 20% yielded fractions with 3- to 4-fold concentrations of organic matter. An argillite containing 1.46% carbon yielded an organic concentrate containing 38.94% carbon. (auth)

10092

SZILARD-CHALMERS PROCESS FOR OSMIUM FROM HEXACHLOROOSMATE(IV) TARGETS. Russell F. Mitchell and Don S. Martin, Jr. (Iowa State Coll., Ames). J. Inorg. and Nuclear Chem. 2, 386-9(1956) July.

A Szilard-Chalmers concentration of Os^{191} has been achieved from targets of $(NH_4)_2$-$OsCl_6$. Recoveries with enrichment factors greater than 10 were attained by a HNO_3 distillation separation of OsO_4 following irradiation. The separation was shown to depend upon the relative kinetics of HNO_3 oxidations. (auth)

10093

EQUILIBRIUM STUDIES ON NATURAL ION-EXCHANGE MINERALS. I. CAESIUM AND STRONTIUM. C. B. Amphlett and L. A. McDonald (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inorg. and Nuclear Chem. 2, 403-14(1956) July.

The uptake of Cs^+ and Sr^{2+} ions has been studied on a Lower Greensand soil of good exchange properties; slight fixation of Cs^+ is observed, but not of Sr^{2+}. Isotherms have been obtained for the system Cs^+–Sr^{2+}–soil at two different ionic concentrations; from these a value of 9.3×10^{-4} has been derived for the thermodynamic equilibrium constant of the exchange reaction $2CsX + Sr^{2+} \rightleftharpoons SrX_2 + 2Cs^+$ where X represents the exchange complex within the soil. Other relevant thermodynamic data have been calculated for this system, and the results are compared with those of other workers on the pure clay mineral montmorillonite. (auth)

10094

THE REDUCTION OF ORE TO METAL. L. M. Pidgeon (Univ. of Toronto, Canada). Metal Progr. 70, No. 2, 81-5(1956) Aug.

The common methods of metal production are discussed. Thermal decomposition was found to be theoretically possible for all metals but most practicable for the noble metals whose oxides exhibit positive free energies of formation. Reduction of oxides with C, CO, or H, displacement with another metal, and electrolysis for production of metals are presented. (J.E.D.)

10095

THE ISOLATION AND DETERMINATION OF PROCTACTINIUM-233. A. J. Fudge and J. L. Woodhead (Atomic Energy Research Establishment, Harwell, Berks, England). Analyst 81, 417-26(1956) July.

In view of the increasing importance of Pa^{233} in the nuclear-energy field, investigations have been carried out with the object of discovering methods for the identification, separation and determination of Pa^{233} in the presence of other activities. Niobium pentoxide was chosen as the

carrier for the preliminary separation. Traces of Zr activity accompanying the Pa were separated by adding ethylenediaminetetraacetic acid to form complexes and then precipitating Nb and Pa with tannic acid at pH 5.0. Separation from Nb was then carried out either by using barium zirconyl fluoride or by paper chromatography. (auth)

10096

THE ION EXCHANGE RESIN AND ITS USES IN THE METALLURGY OF URANIUM. R. De Leone. Energia nucleare (Milan) 3, 168-75(1956) June 15. (In Italian)

A brief survey is given of the principal characteristics of the ion exchange resins, and a description is given of equipment for the production of the raw salts of uranium using anion resins. (B.J.H.)

10097

PRIMARY SEPARATION PLANT AT THE WINDSCALE WORKS. H. G. Davey. Nuclear Power 1, 53-61(1956) June.

Plutonium is manufactured in Britain in the two air-cooled, graphite-moderated piles of the Windscale works of the United Kingdom Atomic Energy Authority. After removal from the piles the irradiated fuel rods are first stored under water for several weeks. They are then dissolved in nitric acid and the solution passed through three towers from which streams of fission products, plutonium and uranium are obtained by solvent extraction with dibutyl carbitol. The plutonium and uranium streams undergo further purification while the fission products are concentrated and stored. The plant has a highly active section and a moderately active one and although it was at first doubted whether access even to the medium active cell would be possible, methods have since been developed for achieving this. Full details of the process are given, and some of the operational problems discussed. (auth)

10098

THE MECHANISM OF THORIUM IV AND URANIUM IV HYDROLYSIS. Sirkka Hietanen (Royal Inst. of Tech., Stockholm, Sweden). Rec. trav. chim. 75, 711-15(1956) June.

The hydrolysis of Th^{4+} and U^{4+} were studied in perchlorate media by electrometric titrations. The pH was measured, and can be deduced from the equilibrium data that a series of complexes are formed. (W.L.H.)

10099

COMPLEXES BETWEEN TRIBUTYL PHOSPHATE AND INORGANIC NITRATES. T. V. Healy and H. A. C. McKay (Atomic Energy Research Establishment, Harwell, Berks, England). Rec. trav. chim. 75, 730-6(1956) June.

Many inorganic nitrates dissolve freely in tributyl phosphate (TBP), forming complexes with the solvent. TBP saturated with uranyl nitrate, for example, corresponds exactly to the composition $UO_2(NO_3)_2 \cdot 2TBP$ and has a sharp melting-point of -6°C; no other complex involving uranyl nitrate and TBP appears to be of any significance. There is only slight ionization in the TBP phase. A useful general method of determining the number of TBP molecules attached to the inorganic nitrate is by partition experiments between TBP and water. The aqueous phase is kept constant in composition while an inert diluent, e.g. benzene or kerosene, is added to the TBP; the partition of a trace of the inorganic nitrate in question is then measured at a series of dilutions. At high dilutions a limiting law of the form: Partition coefficient ~ (TBP Concentration)^n is obtained in which the exponent n gives the number of TBP molecules in the complex. Formulae have been established for different complexes. (auth)

10100

STUDIES ON THE FORMATION OF COMPOSITE COMPLEXES BY MEANS OF AN EXTRACTIVE TECHNIQUE. Jan Rydberg (Research Inst. of National Defense, Sunbyberg, Sweden). Rec. trav. chim. 75, 737-42(1956) June.

The method described has been applied to a number of systems. Equations have been applied on the distribution of U^{4+} and Th between several different organic solvents and water in the presence of acetylacetone. Formation constants have been calculated for the complexes. (W.L.H.)

10101

THE APPLICATION OF SOLVENT EXTRACTION TO THE STUDY OF CHELATE COMPLEXES OF THORIUM. Margareta Dyrssen (Royal Inst. of Tech., Stockholm, Sweden). Rec. trav. chim. 75, 748-52(1956) June.

The extraction method is very useful for studies of the complex formation of metal ions M^{N+} with chelating agents. These reagents are very often organic acids HA which form uncharged complexes MA_N of very low solubility in water but of appreciable solubility in organic solvents. The distribution ratio, q, of the metal M between the two liquid phases is measured as a function of the concentration $[A^-]$ of free ligand. Mathemathical treatment of the function log q (log $[A^-]$) very often enables the calculation of at least two parameters a and b for the complex formation. (auth)

10102

THE INFLUENCE OF THE STRUCTURE OF CHELATING AGENTS ON THE COMPLEXITY AND DISTRIBUTION CONSTANTS OF THORIUM COMPLEXES. David Dyrssen (Research Inst. of National Defence, Sundbyberg, Sweden). Rec. trav. chim. 75, 753-8(1956) June.

A table of coordination compounds, the value of the acid dissociation complexes pKa and mean complexity constants are presented. It has been observed that 5-membered chelate rings are more stable than 6 or 4-membered ones. The stability of the chelate complexes of H^+ and Th^{4+} are discussed. (W.L.H.)

10103

ION EXCHANGE IN THE ATOMIC ENERGY PROGRAM. Robert Kunin and Albert F. Preuss (Rohm & Haas Co., Philadelphia). Ind. Eng. Chem. 48, 30A-5A(1956) Aug.

Ion exchange processes for the recovery of U from ores and ore solutions are described. Other uses of ion exchange in atomic energy programs are briefly outlined. (C.W.H.)

10104

ON THE INFLUENCE OF THE STRUCTURE OF CATION EXCHANGE RESINS IN THE URANIUM–URANIUM X SEPARATION. Roger Lumbroso and Jean Petit. Compt. rend. 243, 145-6(1956) July 9. (In French)

Refer also to abstract 10646.

SORPTION PHENOMENA

10105 AD-70008

New Hampshire. Univ., Durham.

INVESTIGATION INTO THE HETEROGENEITIES OF SOLID SURFACES. Final Report [for] November 1952–June 1955. Dept. of Chemistry. B. Willard, D. Mills and R. Little. 23p. Contract DA-19-020-ORD-2293.

Absorption isotherms were measured for Kr on $BaSO_4$ at −195°C and at −183°C. Isosteric heats of adsorption computed from the two isotherms show that the adsorption of Kr is quite markedly affected by the mode of preparation of the $BaSO_4$. Crystallization from concentrated solutions of H_2SO_4 and $BaCl_2$ yields a surface of much higher energy than crystallization from extremely dilute solutions of the same reagents. (auth)

10106
EFFECTS OF CATION EXCHANGE ADSORPTION ON THE DIELECTRIC CONSTANT OF A MEDIUM. A. T. Davydov and R. F. Skoblionok (Gor'kiĭ Kharkov State Univ.) Kolloid Zhur. 18, 163-6(1956) Mar.-Apr. (In Russian)

Exchange reactions of Ca^{2+} with Li^{+} from aqueous solutions and aqueous alcohol mixtures on the absorbent of different capacities (kaoline, glauconite and volchonskoite) were investigated. It has been established that the composition of the liquid phase has no effect on the quantitative correlations of the process. The capacity of Li^{+} exchange adsorption diminishes with decrease of dielectric constant on the medium. The correlation of the data with the previously obtained data for the adsorption exchange of K^{+} with Na^{+} indicate the strong effects of the solvent and the nature of ions on the capacity of exchange. (tr-auth)

Refer also to abstracts 10016 and 10017.

SPECTROSCOPY

10107
INHERENT INCONSISTENCIES IN FLUORESCENCE AND SCINTILLATION SPECTRA. Donald G. Ott, F. Newton Hayes, Vernon N. Kerr, and Ruth W. Benz (Los Alamos Scientific Lab., N. Mex.). Science 123, 1071(1956) June 15.

SYNTHESES

10108
PREPARATION AND PROPERTIES OF SOME ALKYL-1,2-CYCLOHEXANEDIONE DIOXIMES. Charles V. Banks, Donald T. Hooker, and John J. Richard (Iowa State Coll., Ames). J. Org. Chem. 21, 547-50(1956).

10109
THE BIOGENESIS OF NATURAL AUXINS. S. A. Gordon (Argonne National Lab., Lemont, Ill.). pp.65-75 in "Chemistry and Mode of Action of Plant Growth Substances—Proceedings of a Symposium held at Wye College (Univ. of London), July 1955." R. L. Wain and F. Wightman, eds. London, Butterworths Scientific Publications, 1955.

TRANSURANIC ELEMENTS AND COMPOUNDS

10110 AERE-C/M-82
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
PURIFICATION OF PLUTONIUM THROUGH PLUTONIUM TRICHLORIDE. J. K. Dawson and C. J. Mandleberg. Aug. 1950. 3p.

The dry preparation of $PuCl_3$ is described. The method removes siliceous impurity and can improve the purity of the plutonium from 70 ± 4% to 95 ± 4%, without however achieving a significant reduction in $\beta\gamma$ activity. Its use as a purification step is discussed. (auth)

10111 AERE-N/R-814
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE SPONTANEOUS FISSION RATE OF Pu^{240}. W. Galbraith, K. M. Glover, G. R. Hall, and W. J. Whitehouse. Oct. 29, 1951. 11p.

The spontaneous fission rate of Pu^{240} has been measured, using a sample predominantly composed of Pu^{239} but containing about 4% of Pu^{240} and about 0.01% of Pu^{238}. The percentage of Pu^{240} was estimated by α-particle counting, using published values of the half-lives. The fission rate was determined by direct counting. The result is $(1.43 \pm 0.14) \times 10^{6}$ spontaneous fissions per gm Pu^{240} per hour. The accuracy might be improved by a mass spectrometer measurement upon the plutonium sample. (auth)

10112 AERE-N/R-1109
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
FURTHER EXPERIMENTS ON THE SPONTANEOUS FISSION RATE OF Pu^{240}. F. R. Barclay, W. Galbraith, K. M. Glover, G. R. Hall, and W. J. Whitehouse. Jan. 27, 1953. 3p.

The previous measurement on the spontaneous fission rate of this nuclide has been re-evaluated, using new mass spectrometer results for the percentage of Pu^{240} present in the plutonium film used. The spontaneous fission rate of Pu^{240} is now found from these results to be $(1.58 \pm 0.07) \times 10^{6}$ fissions gm^{-1} $hour^{-1}$. A measurement was also made on a Canadian sample of Pu, and this gave the result $(1.62 \pm 0.04) \times 10^{6}$ fissions gm^{-1} $hour^{-1}$ which is within statistical error of the other result. A weighted mean of the above rates gives the value $(1.61 \pm 0.04) \times 10^{6}$ fissions gm^{-1} $hour^{-1}$. (auth)

10113 NAA-SR-1649
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
EXPERIMENTAL ESTIMATE OF FREE ENERGY OF FORMATION OF PLUTONIUM TRIFLUORIDE. A. G. Buyers. Sept. 1, 1956. 16p. Contract AT-11-1-GEN-8. $3.30(ph OTS); $2.40(mf OTS).

A study involving equilibration at 1573°K of fused UF_4 and molten irradiated U has permitted calculation of the free energy of formation PuF_3 at 1573°K. During equilibration, Pu is extracted into molten uranium fluoride as represented by one of the following equations: $\frac{1}{3}$ Pu (l) + $\frac{1}{4}$ UF_4 (l) $\rightleftharpoons$ $\frac{1}{3}$ PuF_3 (l) + $\frac{1}{4}$ U (l); $\frac{1}{3}$ Pu (l) + $\frac{1}{3}$ UF_3 (l) $\rightleftharpoons$ $\frac{1}{3}$ PuF_3 (l) + $\frac{1}{3}$ U (l); or, $\frac{1}{5}$ UF_4(l) + $\frac{1}{15}$ UF_3 (l) + $\frac{1}{3}$ Pu (l) $\rightleftharpoons$ $\frac{1}{3}$ PuF_3 (l) + $\frac{4}{15}$ U (l). Free energy values for the formation of PuF_3 are calculated from experimentally determined equilibrium constants and the free energies of formation of UF_4 and UF_3, using the expressions: $\frac{1}{3}\Delta F^{\circ}_{PuF_3} = \frac{1}{4}\Delta F^{\circ}_{UF_4} - 2.3\ R\ T \log K_e\ (UF_4)$; or $\frac{1}{3}\Delta F^{\circ}_{PuF_3} = \frac{1}{5}\Delta F^{\circ}_{UF_4} + \frac{1}{15}\Delta F^{\circ}_{UF_3} - 2.3\ R\ T \log K_e$ (for mixtures of UF_4 and UF_3). The free energy of formation at 1573°K for PuF_3 was found to be 93 Kcal/equivalent as compared to an estimated value of 94 Kcal/equivalent at 1500°K based on other work. (auth)

10114
AMERICIUM ELECTRODEPOSITION. Roy Ko (Hanford Atomic Products Operation, Richland, Wash.). Nucleonics 14, No. 7, 74(1956) July.

The electrodeposition was performed at room temperature using Am^{241}. Americium was electrodeposited from a formic acid–ammonium formate solution on stainless steel, Pt, and Cu using a cathodic current density between 50 and 65 $mamp/cm^2$. (W.L.H.)

10115
THE PREPARATION AND PROPERTIES OF SOME PLUTONIUM COMPOUNDS. PART IV. CRYSTALLINE PLUTONIUM NITRATE. J. L. Drummond and G. A. Welch (Chemical Defence Experimental Establishment, Porton, Wilts, England). J. Chem. Soc., 2565-7(1956) July.

A gummy semicrystalline solid phase is formed when concentrated solutions of Pu^{4+} in 1 to 4 M HNO_3 is evaporated the composition of which is not known. It was found that concentrated solutions of Pu tetranitrate in acid will deposit well-formed crystals when allowed to evaporate. Chemical and spectrographic analysis has shown that Pu is the only cation and nitrate the only anion present in the crystals. (W.L.H.)

10116

PLUTONIUM HEXAFLUORIDE. C. J. Mandleberg, H. K. Rae, R. Hurst, G. Long, D. Davies, and K. E. Francis (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inorg. and Nuclear Chem. 2, 358-67(1956) July.

The preparation of PuF_6 by the fluorination of PuF_3, PuF_4, or PuO_2 is described, and the effect of temperature, rate of flow of F_2, duration of reaction, and nature of the starting material is discussed in some detail. The formula PuF_6 has been confirmed by chemical analysis. Several properties of PuF_6 are described, including the vapor pressure, melting-point, decomposition under α-particle irradiation, and reactions with H_2O and H_2SO_4. (auth)

10117

PREPARATION AND PROPERTIES OF PLUTONIUM HEXAFLUORIDE AND IDENTIFICATION OF PLUTONIUM (VI) OXYFLUORIDE. Alan E. Florin, Irving R. Tannenbaum, and Joe F. Lemons (Los Alamos Scientific Lab., N. Mex.). J. Inorg. and Nuclear Chem. 2, 368-79(1956) July.

Plutonium hexafluoride has been identified and characterized. A method of preparation by the fluorination of PuF_4 is outlined. The vapor pressure, which corresponds closely to that of UF_6, has been measured between 0 and 63°C. The vapor pressure is represented by the equations: $\log_{10}P_{liquid}$ (mm) = 7.6923 − 1614.3/T and $\log_{10}P_{solid}$ (mm) = 10.841 − 2634.3/T. The boiling-point is 62.3°C. The heat of sublimation is calculated to be 12.1 kcal/mol. The melting point is 50.7°C. The heat of vaporization is 7.4 kcal/mol. The heat of fusion is 4.7 kcal/mol, and the corresponding entropy of fusion is 14.5 cal/mol °C. A study of the equilibrium, $PuF_4 + F_2 \rightleftharpoons PuF_6$, has resulted in values of 11.5 kcal/mol and 7.8 e.u. for ΔH and ΔS in the temperature range from 167 to 308°C. Respective values of 6.77 and −0.3 were obtained in the range from 308 to 600°. The rates of thermal decomposition and radiolysis were investigated. A solid compound produced when plutonium hexafluoride PuF_6 to moist air was identified as plutonium(VI) oxyfluoride, PuO_2F_2. (auth)

10118

THE PROPERTIES OF PLUTONIUM HEXAFLUORIDE. Bernard Weinstock and John G. Malm (Argonne National Lab., Lemont, Ill.). J. Inorg. and Nuclear Chem. 2, 380-94(1956) July.

PuF_6 is formed rapidly at 750°C by the reaction between PuF_4 and F_2, and high yields are obtained if the PuF_6 is quickly condensed. AmF_6 is not produced under similar conditions. Techniques for the handling, purification, and storage of PuF_6 are described. The molecular structure and crystal structure of PuF_6 are the same as those of UF_6. The melting-point of PuF_6 is 50.75°C. Radiation decomposition of PuF_6 into PuF_4 and F_2 occur at the rate of 1.5% per day for the solid phase. The rate of radiation decomposition is much smaller in the vapor phase, and the system may reach a steady state. Solid PuF_6 is slightly paramagnetic. The absorption spectrum of PuF_6 vapor shows six groups of bands between 5000 and 25,000 A, arising from electronic transitions in the molecule. PuF_6 is a strong fluorinating agent, and its reactions with BrF_3, UF_4, and PuF_3 are described. Thermal decomposition of PuF_6 is not observed at room temperature, but is found to be very rapid at 280°C. The equilibrium constant for the dissociation of PuF_6 into F_2 and PuF_4 is 1.86×10^3 at 220°C; at 25°C, $\Delta F^\circ = -7.6$ kcal mole^{-1}, $\Delta H^\circ = -8.3$ kcal mole^{-1}, and $\Delta S^\circ = -2.3$ cal mole^{-1} deg^{-1} for this dissociation. (auth)

10119

THE CHLORIDE COMPLEXES OF TRIVALENT PLUTONIUM, AMERICIUM, AND CURIUM. M. Ward and G. A. Welch (U. K. Atomic Energy Authority, Sellafield, Cumb., England). J. Inorg. and Nuclear Chem. 2, 395-402(1956) July.

The dissociation constants of the monochloride complexes of Pu^{3+}, have been found to be identical in dilute HCl solutions, with a value of 0.068 corrected to zero ionic strength. In concentrated hydrochloric-acid solutions the relative complexing power has been shown to be Pu ≫ Am > Cr. This result has been discussed with reference to a theory of f-orbital hybridization in the actinides. (auth)

Refer also to abstracts 10304, 10566, and 10669.

TRITIUM AND TRITIUM COMPOUNDS

Refer to abstract 10026.

URANIUM AND URANIUM COMPOUNDS

10120 ANL-5603

Argonne National Lab., Lemont, Ill.

THE HEAT CAPACITY AND THERMODYNAMIC FUNCTIONS OF TETRAURANIUM NONOXIDE FROM 5 TO 310°K. Darrell W. Osborne, Edgar F. Westrum, Jr., and Harold R. Lohr. Aug. 1956. 6p. Contract W-31-109-eng-38. $0.15(OTS).

The heat capacity of U_4O_9 was measured from 5 to 310°K; from these data the entropy, enthalpy, and free energy function were calculated. At 298.16°K, the values of C_p, S°, $(H^\circ - H_0^\circ)/T$, and $(F^\circ - H_0^\circ)/T$ are 70.11 ± 0.07, 80.29 ± 0.08, 40.69 ± 0.04, and 39.60 ± 0.04 cal deg^{-1} mole^{-1}, respectively. In contrast to the behavior of UO_2, there is no anomaly in the heat capacity of U_4O_9 in the temperature range investigated. (auth)

10121

EXTRACTION OF URANYL NITRATE WITH ORGANIC SOLVENTS. A. Cacciari, R. De Leone, C. Fizzotti, and M. Gabaglio (Laboratori CISE, Milan). Energia nucleare (Milan) 3, 176-81(1956) June 15. (In Italian)

A study was made of the influence of the "salting" and of the presence of HNO_3 on the extraction of uranyl nitrate with methyl isobutyl ketone. In the same conditions, the extraction of the ferric nitrate was estimated. A determination was also made of the effect of the presence in the extraction solutions of sulfates, phosphates and chlorides. The results are reported in graphs which show the variation of the distribution coefficient in each case examined. (tr-auth)

10122

PEROXIDE DECOMPOSITION IN AQUEOUS HOMOGENEOUS REACTOR FUELS. M. D. Silverman, G. M. Watson, and H. F. McDuffie (Oak Ridge National Lab., Tenn.). Ind. Eng. Chem. 48, 1238-41(1956) Aug.

The decomposition of peroxide in UO_2SO_4 solutions has been found to be first order in peroxide and independent of the U concentration. The rate also appears to be independent of the acidity of the solution as long as no excess acid is present. First-order specific reaction-rate constants have been determined at 53, 78, and 100°C. A conductance method has been developed for following the decomposition at excessively fast rates which preclude successful use of standard chemical methods. Catalytic effects caused by probable corrosion and fission product species present in homogeneous reactor solutions have been studied by this technique. Allowable operating power levels for aqueous homogeneous reactors have been estimated from the data. (ICE abst.)

10123

THE REACTION OF URANYL ION WITH XANTHATES AND DIETHYLDITHIOCARBAMATE. Ralph A. Zingaro (Texas A & M, College Station and Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 78, 3568-70(1956) Aug. 5.

In the presence of potassium ion, some xanthates and diethyldithiocarbamate have been found to form precipi-

tates corresponding to the formula KUO_2X_3, where X is the xanthate or diethyldithiocarbamate radical. On the basis of spectrophotometric data, a double salt structure of the type $UO_2X_2 \cdot K_2UO_2X_4$ is indicated for the diethyldithiocarbamate complex. (auth)

Refer also to abstracts 10030 and 10035.

WASTE DISPOSAL

10124 AERE-C/R-1686
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
FIXATION OF ACTIVITY IN SOLID FORM BY ABSORPTION ON SOILS. PART I. FIRING AND LEACHING TESTS. C. B. Amphlett and D. T. Warren. June 1956. 11p. (FPSD/P-15).

The absorption of radioactivity from waste solutions on soils, followed by firing at high temperatures, has been studied as an alternative to fixation processes involving clay minerals. Fixation on soil is as efficient as on clay. Two types of process have been investigated, one based on ion exchange, and one in which the soil is used as a base for manufacture of a ceramic product by mixing with the waste and firing. Both types of operation give high decontamination factors under suitable conditions, but the second enables a higher loading to be achieved and is applicable to a much wider variety of wastes. The engineering problems associated with large-scale operation are simpler in the first case, although there is no doubt that the second system can also be scaled up if desired. (auth)

10125
A SYSTEM WHICH CONTINUOUSLY RECORDS WATER LEVEL AND CONTAMINATION. Ford Kalil and J. M. Garner, Jr. (Oak Ridge National Lab., Tenn.). Nucleonics 14, No. 7, 56-60(1956) July.

The system consists of a gamma-radiation monitor which continuously measures the radiation dose of the lakes or streams in which waste is deposited. A continuous water-elevation recorder, and a telemetering system which transmits the water level and radiation dose to a central station are described. (W.L.H.)

10126
THE DISPERSAL OF EFFLUENT IN THE SEA. J. Wright (Atomic Energy Research Establishment, Harwell, Berks, England). Atomics 7, 274-9(1956) Aug.

The aspects of radioactive effluent disposal from the chemical plant to be associated with the British Pu production piles are briefly discussed. Experiments were made to determine the nature of processes leading to physical dispersion of the radioactivity from the point of discharge in the sea. A general summary of the results is included. (B.J.H.)

ENGINEERING

10127 AERE-E/R-663
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
CRITICAL SPEEDS OF ROTOR IN GAS JOURNAL BEARING. J. Woodrow. Mar. 5, 1951. 18p.

An investigation is carried out, into the motion of a symmetrical rotor in a gas journal bearing for two cases (a) when the out-of-balance is purely static, (b) when the out-of-balance is purely dynamic. The results apply to the general case of non-linear jet forces, and non-linear damping due to viscous forces in the clearance. Expressions are derived for the maximum permissible static and dynamic out-of-balance to ensure safe running clearances. As far as whirling is concerned, any design of rotor, which makes the transverse and axial moments of inertia equal, is to be avoided. (auth)

10128 CCC-1024-TR-195
Callery Chemical Co., Penna.
ANALYSIS OF POWER REQUIREMENTS AND DISPERSION ACTION OF MIXING IMPELLERS. D. K. Eads—P. M. Maginnity, ed. Aug. 2, 1956. 24p. Contract [NOa(s)-52-1023-c].

An analysis has been made of the related problems of mixing and dispersion, in operations performed by means of radial turbines, "Dispersators", and form drag impellers. By the application of a modified form of dimensional analysis, expressions were derived for the power number, the Reynolds number, the Weber number, and a new group which has been called the time number—in such a way that these numbers take into account impeller geometry. A correlation of power requirements for flat six-bladed radial turbines was obtained. Tentative values for these dimensionless ratios (except the time number) were established for the first two impeller types. No data were available for the time number, but it is suggested that its use should prove valuable in certain types of dispersion and reaction problems. (auth)

10129 DP-126
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
COMPUTATIONS ON THE PERFORMANCE OF A POWER STATION I. AUTOMATIC EXTRACTION TURBOGENERATORS. R. R. Haefner. Oct. 1955. 16p. Contract AT(07-2)-1. $0.20(OTS).

A method is described in which an IBM 650 computer is used to determine the electrical output of a steam power station under all practical modes of operation. The output was calculated and actual production of electricity differed by less than one %. (auth)

10130 NP-6068
Mine Safety Appliances Co., Callery, Penna.
PROGRESS REPORT NO. 35 FOR JUNE AND JULY 1956. W. J. Posey, ed. Aug. 9, 1956. 75p. Contract NObs-65426.

Testing of the 3000 KW steam generator continues. The development of a high-temperature pressure gage for use with liquid metals is complete. Failures in previously operated type 347 stainless steel steam generators have been encountered and have generally been attributed to chloride stress corrosion in the tube sheet area. An evaporator has been designed and constructed entirely of 2¼% Cr–1% Mo steel. A mixture of 1% Fe_3O_4 and 0.2% asbestos will plug small leaks in NaK–water leaks in systems such as the S_2G evaporator and superheater. Experiments are continuing on nitriding in Na systems and Na systems containing Ca. Two designs of liquid-level gages for liquid metals using displacement floats are being developed to operate at high temperatures inside a pressurized vessel. Isopropyl biphenyl, a proposed organic moderator-coolant is being tested under neutron flux. A high-velocity corrosion system has been operated for 30 days to test 9 materials in 800°F biphenyl at 27, 9, 4, and 0 fps velocities. (For preceding period see NP-5991.) (W.L.H.)

10131 SC-7016(SP)
[Sandia Corp., Albuquerque, N. Mex.]
TOLERANCES OF POSITION AND FORM, INCLUDING MMC. Sept. 15, 1955. Changed from OFFICIAL USE ONLY July 9, 1956. 40p. $6.30(ph OTS); $3.00(mf OTS).

The tolerance notation used on Sandia Corp. drawings is explained. (D.E.B.)

10132 WAPD-PWR-CP-2231
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh]. PWR CHEMISTRY PROGRAM, JUNE 1956. 35p. $6.30 (ph OTS); $3.00(mf OTS).

A detailed outline of the technical activities of the Pressurized Water Reactor Chemistry Section is presented. (T.R.H.)

10133
ADVANCES IN CHEMICAL ENGINEERING. VOLUME I. Thomas B. Drew and John W. Hoopes, Jr., eds. New York, Academic Press Inc., 1956. 448p.

Review articles are presented on the following: boiling of liquids; fluid mechanics, mixing, and heat transfer in non-Newtonian materials; theory of diffusion; turbulence in thermal and material transport; mechanically aided liquid extraction; automatic computer in manufacturing operations; and radiation effects on chemical and biological processes. (C.W.H.)

Refer also to abstracts 9906.

HEAT TRANSFER AND FLUID FLOW

10134 EDR-841
Allison Div., General Motors Corp., Indianapolis.
COUNTERFLOW HEAT EXCHANGER TRANSIENT STUDIES. Summary Report. Earl R. McMinn. June 5, 1956. 91p. Contract NOas-56-411.

Heat transfer analog transient studies were compared to the digital computer calculations and found to be in agreement. The analog or heat transfer simulator has the advantage of using an over-all engine or power-plant simulator or computer to study the over-all performance for determining control requirements, and gives a method for future analog studies of a complete power plant in order to determine the proper control system. These studies show that for temperature or fluid flow step changes, the temperatures in the circuit change rapidly. The time required for a 0.632 $(1-1/e)$ change in temperature for the cold fluid, when a step change in hot fluid temperature of cold fluid flow rate is made, is 0.35 seconds for the analog study and only 0.10 seconds for the digital computer method. Curve sheets for various temperatures of the hot liquid, cold liquid, and wall throughout the length of the heat exchanger, and a comparison chart showing the cold fluid temperature versus time for a step change in hot fluid temperature from 1500 to 1600°F for the analog and computer methods are given. (F.S.)

10135 NP-6087
Mine Safety Applicances Co., Callery, Penna.
TESTS OF A FILLING PROCEDURE FOR THIRD FLUID SYSTEM OF COMBUSTION ENGINEERING EVAPORATOR. Memo Report 118. V. K. Heckel and E. C. King. Aug. 27, 1956. 13p. Contract NObs-65426.

During preparation for installing the Combustion Engineering evaporator, it was discovered that the third fluid passages of many of the tubes were restricted to such an extent that it was questionable that they could be completely filled with NaK. Tests were devised to determine a method of filling the third fluid passages and determine the voids remaining after filling. The relative degree of restriction and volume of each of the 10 third fluid passages were successfully filled and the tests indicate that it should be possible to fill the evaporator by this method even though some of the third fluid passages are partially plugged. (auth)

10136
THE USE OF SODIUM AND OF SODIUM–POTASSIUM ALLOY AS A HEAT-TRANSFER MEDIUM. II. W. B. Hall and T. I. M. Crofts (U. K. Atomic Energy Authority, Sellafield, England). Atomics 7, 189-93(1956) June.

The applications of liquid metals in heat-transfer problems are discussed, and comparisons are drawn between those metals whose melting points are sufficiently low to make them of interest in this respect. A number of sodium and sodium-potassium circuits which have been built and operated over the past three years are described; some of these were built in order to gain experience in handling the liquid metals, while others were for heat-transfer experiments. A general discussion on the design and construction of liquid metal circuits and the components which are commonly used in them is given. A brief discussion of forced-convection heat-transfer with liquid metals follows, and the results of some work on cavitation in sodium-potassium eutectic flowing through a constriction in a pipe are summarized. (auth)

10137
CALCULATIONS OF GAS FLOW WITH THE SPEED OF SOUND THROUGH A LAVAL JET, CONSIDERING THE VISCOSITY AND HEAT EXCHANGE. K. S. Bolotina. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk, 3-11(1956) May. (In Russian)

Calculations were made for viscous gas flow in an axisymmetrical jet; the equations were obtained for the irregular distribution of velocities and temperatures along the cross section of a jet. The terms of viscosity and heat exchange were expressed by the viscosity, the thermal conductivity, and the boundary layer thickness coefficients. Evaluations for viscosity "slip", viscosity volume, and thermal conductivity permitted the transitions of the flow with the speed of sound to be formulated. The variations in velocities, temperatures, and pressures along the jet axis and the gradients of velocities and temperatures in critical cross section were compared and evaluated. (tr-auth)

10138
ON THE EQUATIONS FOR HEAT TRANSITION DURING TURBULENT FLOW IN A TUBE. E. Rukenshteĭn (Bukharest Polytechnic Inst.). Izvest. Akad. Nauk S.S.S.R. Otdel Tekh. Nauk, 23-8(1956) May. (In Russian)

Mathematical analysis was made of the turbulent flow in a tube for local conditions and for the flow as a whole. The equations for the total flow include the mean temperatures and the coefficients of heat exchange. (R.V.J.)

10139
GAS FLOW IN RECTILINEAR CHANNELS. M. G. Dubinskiĭ. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk, 110-12(1956) May. (In Russian)

A mathematical analysis has been made of gas flow in rectilinear channels considering the mean velocity along the cross section and the effect of friction at the gas-wall contact but disregarding stream breaks and rapid condensation in the supersonic flow region. (R.V.J.)

10140
FORCED HEAT CONVECTION IN PIPES. Leonard Topper (Johns Hopkins Univ., Baltimore). Ind. Eng. Chem. 48, 1379-82(1956) Aug.

Nuclear reactors and some other kinds of heat sources are operated essentially to warm a fluid that passes through a tube, the wall heat flux remaining constant. An analysis of the temperature distribution, assuming plug flow of the fluid, is presented. The results should be of interest in the kinetics of zero order processes that occur at the wall of a tubular chemical reactor. (ICE abst.)

10141
USE OF NUMERICAL ANALYSIS IN THE TRANSIENT SOLUTION OF TWO-DIMENSIONAL HEAT-TRANSFER PROBLEM WITH NATURAL AND FORCED CONVECTION.

S. K. Hellman, George Habetler, and Harold Babrov, (Knolls Atomic Power Lab., Schenectady, N. Y.). Trans. Am. Soc. Mech. Engrs. 78, 1155-61(1956) Aug.

In order to determine thermal stresses in a nuclear reactor during power build-up and decay, it is necessary to derive a method of evaluating the transient temperatures involved. This paper presents an analysis of a two-dimensional metallic structure containing many flow channels. Cooling is accomplished through natural and forced convection. Heat generation and conduction are considered as functions of time and two space variables; while the laminar motion of the liquid metal is expressed by means of transient one-dimensional flow-rate equations, derived from Euler's equation. The system is set up as a thermal network so that the resulting finite difference equations can be solved by a digital computer. (auth)

10142

MEASUREMENT OF MEAN FLUID TEMPERATURES. Lloyd Trefethen (Harvard Univ., Cambridge, Mass.). Trans. Am. Soc. Mech. Engrs. 78, 1207-12(1956) Aug.

It is shown that the mean temperature obtained for a section of a heat exchanger varies with the technique of measurement. Because of axial heat flow, neither a mixing box, nor temperature and velocity probes in a turbulent fluid, will give the energy mean temperature of the moving fluid. For long, thin-walled, uniformly heated tubes, the inherent discrepancy due to the use of a mixing-box mean temperature is negligible if RePr > 30. The tube and apparatus, however, may have an axial conductivity many times that of the fluid, and it is shown that some of the experimental data for liquid metals may have been influenced by this axial heat-flow discrepancy. (auth)

10143

METAL TRANSPORT IN LIQUID-WATER SYSTEMS AND EFFECT ON HEAT TRANSFER. S. C. Datsko (Babcock & Wilcox Co., Alliance, Ohio). Trans. Am. Soc. Mech. Engrs. 78, 1223-7(1956) Aug.

A series of tests was conducted to determine the effects on heat transfer caused by the corrosion by water of Zr tubes and by the deposition of corrosion products of a stainless-steel system on the Zr-tube walls. Tests were conducted at water velocities from 2 to 30 fps and heat-flow rates from 30,000 to 500,000 Btu hr-sq ft of surface in single-tube, countercurrent, water-to-water heat exchangers. The heating-water temperature ranged between 500 and 620°F and the cooling-water temperature between 450 and 500°F. Several water treatments, such as deionization and O or H additions, were investigated. Results of these tests are given in the paper. (auth)

10144

CORRELATION TENSORS IN STATISTICAL HYDRODYNAMICS IN POROUS MEDIA. A. E. Scheidegger (Dominion Observatory, Ottawa, Canada). Can. J. Phys. 34, 692-8 (1956) July.

The author's statistical theory of flow through porous media, based upon an extremely simple model in which pressure fluctuations are being neglected, has been criticized because velocity correlation tensors had not been introduced as dynamical variables. It is shown in the present paper that the introduction of such variables is not useful in the author's theory. This is due to the particularly simple nature of the model employed and does not imply that the use of correlation tensors may not lead to something useful in other conceivable statistical theories. (auth)

MATERIALS TESTING

10145 WADC-TR-55-351

Connecticut Hard Rubber Co., New Haven.

TESTING OF SILICONE RUBBER AT ELEVATED TEMPERATURES. Period covered: July 1 to August 15, 1955. Aldo J. DeFrancesco. Jan. 1956. 40p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task title: COMPOUNDING OF ELASTOMERS. Contract AF33(616)-2452. (PB-121192).

An apparatus was designed and constructed to measure tensile strength, elongation, and tear strength of silicone rubber at elevated temperatures. Fifteen silicone compounds were tested at room temperature, 212, and 400°F. Physical properties of silicone rubber are slightly affected after the rubber is aged at high temperatures, but they are greatly reduced when measured at high temperatures. The results for the 15 compounds are tabulated. (F.S.)

10146 WADC-TR-56-370

Shell Development Co., Emeryville, Calif.

RESEARCH IN HIGH TEMPERATURE BEARING LUBRICATION IN THE ABSENCE OF LIQUID LUBRICANTS. Final Report [for] May 1, 1955—April 30, 1956. Charles H. Bailey and Stanley S. Sorem. May 1956. 51p. Project title: AVAITION LUBRICANTS. Task title: LUBRICANTS. Contract AF33(616)-2999.

The applicability of the "protective atmosphere" system to the operation of high temperature alloy rolling element bearings at temperatures from 600 to 800°F is being investigated. This system involves surrounding the operating bearing with a reducing atmosphere consisting of a mixture of organic vapor and a volatile extreme pressure additive in air. The reducing environment prevents the formation of destructive abrasive metal oxides. Reactions of the extreme pressure additive and the organic vapor with or on the metal surfaces results in the formation of films which provide the necessary "lubrication" for high temperature operation. Results of this investigation to date show that the "protective atmosphere" system is applicable to bearings constructed to ferrous alloys. Bearings with tool steel balls and races and steel cages appear best suited. The desired films cannot be formed on metals of low oxidation potential such as bronze or silver nor on the oxidation resistant alloys such as the stainless steels. The contribution of the organic portion of the atmosphere to the protective film formation has only recently been recognized. Exploitation of this discovery may lead to further improvements in "protective atmosphere" composition. Best results thus far have been obtained with a "protective atmosphere" consisting of a mixture of air and JP-4 fuel vapor in a weight ratio of 8 to 1. The JP-4 used contained about 0.2% sulfur. In this atmosphere a size 206 all ferrous metal bearing has been operated 100 hours at 10,000 rpm and 700°F without appreciable wear or other indications of bearing deterioration. The limits of the "protective atmosphere" system with respect to bearing temperature, speed and load are yet to be determined. (auth)

10147

INVESTIGATION OF STATIC AND FATIGUE RESISTANCE OF MODEL PRESSURE VESSELS. Julien Dubuc and Georges Welter (Ecole Polytechnique, Montreal, Canada). Welding J. (N. Y.) 35, 329s-37s(1956) July.

Results of an investigation sponsored by the Pressure Vessel Research Committee indicate remarkable performance for vessels subjected to extreme static and cyclic loading. These tests point out the need for careful design details in order to minimize stress concentration effects which produce fatigue failures. (F.S.)

TRACER APPLICATIONS

10148

CUTTING TOOLS AND RADIOISOTOPES. USE OF RADIO-

ACTIVE TRACER ELEMENTS IN DETERMINING CUTTING-TOOL LIFE. Atomics 7, 229-32 & 247(1956) July.

VACUUM SYSTEMS

10149 HE-150-84

California. Univ., Berkeley. Inst. of Engineering Research.

FLUID FLOW AND HEAT TRANSFER AT LOW PRESSURES AND TEMPERATURES. APPENDIX I. VACUUM VESSEL CONSTRUCTION TECHNIQUES AND SEALING METHODS. D. O. Horning. May 15, 1951. 36p. Project NR-061-003. Contract N7-ONR-295. (ATI-144081).

Special problems of vacuum system design for wind tunnels which must be studied and evaluated by the vacuum engineer are presented. Leaks, leakage, seals, construction materials, windows and outgassing are discussed along with general design considerations. (T.R.H.)

MINERALOGY, METALLURGY, AND CERAMICS

10150 AD-43649

Temple Univ., Philadelphia. Research Inst.

HIGH TEMPERATURE PROJECT. Progress Report No. 9 from July 1, 1953 to January 1, 1954. J. B. Conway and Maurice S. Kirshenbaum. Jan. 1, 1954. 35p. Contract N9-onr-87301.

Experimental results are given on the combustion of Ti and Ca powders, the ignition temperature of metals, and the mechanism of the combustion of metals. (F.S.)

10151 AD-81028

New York Univ., New York. Coll. of Engineering.

THERMODYNAMIC PROPERTIES OF TITANIUM HALIDES IN MOLTEN SALT SYSTEMS. Technical Report No. 2. P. Herasymenko. Nov. 1955. 36p. Contract Nonr-285 (13).

A simplified apparatus for collecting vapors which are in equilibrium with solid or molten salts is described. When the vapors of di-, tri- and tetrachloride existing in equilibrium with solid $TiCl_2$ its solutions in molten $MgCl_2$ are entrapped in a Ti pipette and the pipette is cooled down to room temperature, the reactions of higher titanium chlorides with the metal during cooling cannot be prevented. The resulting composition of the salt condensed in the pipette corresponds to that of $TiCl_2$. The apparent total content of Ti and Cl atom obtained by the analysis of the salt vapors condensed in the pipette is correlated with the number of moles, present in the pipette at equilibrium at elevated temperature. The apparent total concentrations of Ti atoms, (Σ'Ti), in the vapor over solid $TiCl_2$ were found to be of the same order of magnitude as the corresponding values derived in recent thermodynamic estimates. Mixtures of $MgCl_2$ and $TiCl_2$ containing more than 40 mol. % $TiCl_2$ have practically the same apparent total concentration of Ti atoms in the vapor phase at temperatures above 750°C as the vapor over pure solid $TiCl_2$. This indicates that molten $MgCl_2$ was saturated with solid $TiCl_2$ in these mixtures. The apparent activity of $TiCl_2$ in dilute solutions in molten $MgCl_2$ (up to 2.4 mol. % $TiCl_2$) was found to be about 4 × higher than the activity of ideal solutions. The results indicate that the solubility of $TiCl_2$ in molten $MgCl_2$ lies in the interval from about 15 to 40 mol. % $TiCl_2$ at about 800°C. (auth)

CERAMICS AND REFRACTORIES

10152 WADC-TR-54-33(Pt. 2)

Ohio State Univ. Research Foundation, Columbus.

PRELIMINARY MICROSCOPIC STUDIES OF CERMETS AT HIGH TEMPERATURES. [Period covered] March 1, 1953 to September 30, 1954. Thomas S. Shevlin, Herbert W. Newkirk, E. George Stevens, and Harold M. Greenhouse. Feb. 1956. 141p. Project title: CERAMIC AND CERMET MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF33(038)-16911. (AD-90041).

Preliminary studies were made of changes in the microstructure of TiC base cermets, with time at high temperatures; high temperature x-ray diffraction on phases stable at 2000°F in TiC; electron microscopy of some TiC base cermets; coefficient of expansion of high-temperature alloys; preparation of high Ni-low TiC cermets for impact and thermal shock studies; investigation of TiB_2 and $MoSi_2$ as the ceramic components of a cermet; and the effect of heat treatment on impact strength of cermets. (J.E.D.)

10153 WADC-TR-54-172(Pt. II)

Ohio State Univ. Research Foundation, Columbus.

CERAMIC-FIBER BASE CERMETS. [Period covered] March 1, 1954 through February 1, 1955. Louis J. Trostel, Jr. Feb. 1955. 35p. Project title: CERAMIC AND CERMET MATERIALS. Task title: IMPROVEMENTS IN THE FABRICATION AND PROPERTIES OF NEW CERAMIC TYPE MATERIALS. Contract AF33(616)-472. (AD-90042).

Research studies on cermets composed of mixtures of ceramic oxide fibers and powdered metals are described. Hot pressing techniques were successful in the fabrication of specimens. Hot-pressed specimens exhibited cross bending strength twice that of sintered specimens. Materials tested included highly silicious or aluminum silicate fibers, each bonded with 91% by weight of stainless steel. (auth)

10154

HEATS OF FORMATION OF NIOBIUM NITRIDE, TANTALUM NITRIDE AND ZIRCONIUM NITRIDE FROM COMBUSTION CALORIMETRY. Alla D. Mah and Norma L. Gellert (U. S. Bureau of Mines, Berkeley, Calif.). J. Am. Chem. Soc. 78, 3261-3(1956) July 20.

The energies of combustion of (NbN), (TaN) and (ZrN) were determined with a bomb calorimeter at 30 atm pressure of oxygen and 303.15°K as 1592.8, 943.0 and 1652.6 cal/g, respectively. These results, in conjunction with the heats of formation of the corresponding oxides, lead to the following values of the heats of formation of the nitrides (kcal/mole) at 298.15°K: -56.8 ± 0.4 for NbN, -60.0 ± 0.6 for TaN and -87.3 ± 0.4 for ZrN. (auth)

10155

THE HEAT CAPACITY OF RHENIUM HEPTOXIDE FROM 15 TO 300°K ENTROPY AND FREE ENERGY. R. H. Busey (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 78, 3263-6(1956) July 20.

Low temperature heat capacity data on rhenium heptoxide are presented and the thermodynamic functions for this heptoxide are tabulated. The entropy of Re_2O_7 at 298.16°K. is given as 49.54 ± 0.05 cal/mole/°C. The following thermochemical values have been calculated: $S^\circ_{298.16}$ (Re_2O_7(g), ideal gas at 1 atm.) = 105.0 ± 0.3 cal/mole/°C; $S^\circ_{298.16}$ ($HReO_4$(c)) = 36.4 ± 0.2 cal/mole/°C; $\Delta F^\circ_f(Re_2O_7(c)) = -255.0 \pm 2.0$ kcal. mole^{-1}; $\Delta F^\circ_f(HReO_4(c)) = -157.0 \pm 1.0$ kcal. mole^{-1}. Data obtained on a Calorimetry Conference standard sample of benzoic acid are compared with results obtained by National Bureau of Standards investigators. The agreement shown is quite satisfactory. (auth)

CORROSION

10156 AECU-3293

Johns Hopkins Univ., Baltimore. Inst. for Cooperative Research.

MEASUREMENT OF THICKNESS OF THIN OXIDE FILMS. Report No. 1. John M. Kopper. Apr. 8, 1953. 12p. For Westinghouse Electric Corp. [Atomic Power Div.] Contract AT-11-1-GEN-14, Subcontract No. 14-328. $3.30 (ph OTS): $2.40(mf OTS).

Three electrical methods were used to detect the corrosion products on Zr and other metals and to measure the film thickness of the corrosion products. A series of tests showed that the capacitance method gave the best results. The method is described in detail. (W.L.H.)

10157 AECU-3294

Johns Hopkins Univ., Baltimore. Inst. for Cooperative Research.

MEASUREMENT OF THICKNESS OF THIN OXIDE FILMS. Report No. 3. John M. Kopper. Oct. 15, 1954. 69p. For Westinghouse Electric Corp. [Atomic Power Div.] Contract AT-11-1-GEN-14, Subcontract No. 14-328. $10.80(ph OTS); $3.90(mf OTS).

The results are summarized of measurements of electrical capacitance and dissipation of the films formed on three different stainless steels, made for the purpose of studying changes in thickness and structure of the films as a function of prior water treatment and prior method of polishing. Exposure temperatures up to 600°F, and measuring frequencies from 0.25 to 10 kilocycles per second were used. (auth)

10158 AECU-3295

Johns Hopkins Univ., Baltimore. Inst. for Cooperative Research.

INFRA RED STUDIES OF SURFACE FILMS. Final Report. William G. Fastie. June 1, 1954. 10p. For Westinghouse Electric Corp. [Atomic Power Div.] Contract AT-11-1-GEN-14, Subcontract No. 14-328. $1.80 (ph OTS); $1.80(mf OTS).

It is feasible, over certain thickness ranges to determine the thickness of films on Zr plates, both by optical interference measurements and optical absorption measurements. However, a number of factors, not the least of which are the complexity of the optical equipment and the fact tnat the surfaces in some cases must be measured in situ, militate against the optical method. It would appear that the method may be valuable for a basic calibration of other instruments or for detecting small differences in thickness between similarly treated laboratory specimens. The infra red reflection spectrum of Zr surface films shows several maxima and minima which are due to ZrO_2. A study of films on Zr alloy plates failed to show differences which could be attributed to the alloying constituents. (auth)

10159 AECU-3296

Johns Hopkins Univ., Baltimore. Inst. for Cooperative Research.

EMISSION SPECTRA OF CORROSION FILMS. Final Report. William G. Fastie. June 1, 1954. 10p. For Westinghouse Electric Corp. [Atomic Power Div.] Contract AT-11-1-GEN-14, Subcontract No. 14-328. $1.80 (ph OTS); $1.80(mf OTS).

By burning in a carbon arc material which was stripped from the corroded surface of a stainless steel plate and photographing the emission spectrum of the arc stream, it has been found possible to analyze the metallic constituents of the surface film qualitatively and to show that there are startling differences in the films which depend on the method of preparing the surface of the plate before corrosion is initiated, the method of corroding the surface, and, of course, the composition of the alloy. The results indicate that trace elements in the steel may have an important role in the corrosion process. Another important result is that the most important alloying constituent, chromium, does not appear, under any condition, as a constituent of the surface film. It appears that by employing careful spectroscopic techniques involving, among other things, preparation of standard samples of metallic salt mixtures and by further developing and standardizing the method of film stripping, the method described herein can be made quantitative and would then be a valuable tool in the study of the corrosion process. (auth)

10160 AERE-C/M-250

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

CORROSION AND THE URANYL SULPHATE REACTOR (H.A.R.E.); PRELIMINARY EXPERIMENTS USING THE POTENTIOSTAT. R. B. Jacobi. Nov. 1955. 15p. (HARD(C)P/2).

The tendency of a metal specimen to corrode in a solution was studied. A method is described for controlling the current at the electrodes by the use of a potentiostat. Several experiments have been performed using this instrument in the electrolytic corrosion of stainless steel in H_2SO_4 and the corrosion of stainless steel in UO_2SO_4. The results of these tests are presented. (W.L.H.)

10161 BMI-1118

Battelle Memorial Inst., Columbus, Ohio.

CORROSION AND COMPONENTS STUDIES ON SYSTEMS CONTAINING FUSED NaOH. Eugene M. Simons, Neil E. Miller, John H. Stang, and C. Vernon Weaver. July 30, 1956. 46p. Contract W-7405-eng-92. $0.35(OTS).

Information is presented from a group of experiments in which the corrosiveness of fused NaOH (900 to 1500°F) was examined. Cold zones of all Ni natural- and forced-convection loops in which H-blanketed NaOH was circulated at peak temperatures of 1200 to 1500°F with temperature cycles in the range of 100 to 200°F plugged severely by Ni deposition in times ranging from less than 10 to 200 hr. In 900 and 1050°F peak-temperature experiments with all Ni pumping-loop systems, considerably better results were obtained. For example, after 2000 hr of operation, a 900 to 70°F thermal-cycle system displayed a cold-zone metal transfer of only 5 mils. This result indicates that, in this temperature range, a reasonable life for a NaOH flow system is possible, although a relatively low fluid-temperature cycle would be required. Several corrosion inhibitors evaluated in static capsule experiments failed to depress the corrosiveness of 1500°F NaOH. On additive, MgO, appeared to inhibit attack noticeably but its effect was far from enough to eliminate the problem. In addition to the corrosion work, experiments were conducted to evaluate components requirements for NaOH flow systems. These indicated that the straightforward engineering approaches to components problems in large-scale flow systems would be generally successful, providing the materials problems were solved. There would, however, be a special need for extensive work on components that would require pressure-sensing elements and those that would function as seals, both static and dynamic. Frozen-type seals, which hold some promise for the latter application, received considerable attention during the experimental phases of this work. (auth)

10162 CF-55-9-65

Oak Ridge National Lab., Tenn.

REPORT ON CORROSION OF TITANIUM IMPELLER NUMBER ONE. J. C. Griess, T. M. Kegley, and J. L.

Gregg. Sept. 15, 1955. 10p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

After 12,000 hrs of corrosion testing in UO_2SO_4 solutions without corrosion damage, a Ti impeller failed from severe corrosion damage. Samples of corrosion products indicate that the damage was caused by rapid oxidation. The fused surface condition seems to indicate that the surface temperature rose to 2000°C. (F.S.)

10163 TID-3302
Technical Information Service Extension, AEC.
CORROSION: A BIBLIOGRAPHY OF UNCLASSIFIED REPORT LITERATURE. July 1956. 36p. $0.30(OTS).

This bibliography contains 111 annotated references to classified reports on the corrosion of alloys, commercial alloys, ceramics, and plastics. References are included to reports written prior to Dec. 15, 1953. Author, subject, and report number indexes are provided. (auth)

10164
STRESS-CORROSION CRACKING OF TYPE 304 AUSTENITIC STAINLESS STEEL. H. L. Logan (National Bureau of Standards, Washington, D. C.) and R. J. Sherman, Jr. (Naval Research Lab., Washington, D. C.). Welding J. (N. Y.) 35, 389s-95s(1956) Aug.

In a study of the mechanism of stress-corrosion cracking approximately 40 solutions were investigated as possible corrodents to be used in stress-corrosion tests of types 304 and 304L stainless steels. A boiling 3½% NaCl-1% commercial NH_4NO_2 solution, pH 7.0, produced stress corrosion cracking in a few hours in the 304 steel stressed to 80% or more, and in the 304L steel stressed to 100% or more of their room temperature yield strengths. Cracking was produced in 0.2-in. gage lengths strained 0.5% or more. There was, however, no correlation between macroscopic strain and tendency to develop stress-corrosion cracks. Pitting was generally produced by solutions having pH's less than 4.0. Studies of the developments of cracks, made both by interrupting tests and by photographing specimens in situ indicated that stress-corrosion cracks can develop with little, or possibly no, previous pitting. Limited data indicate that stress-corrosion cracking is not limited to any particular crystallographic plane or set of planes. (auth)

GEOLOGY AND MINERALOGY

10165 ORO-154
Tennessee. Univ., Knoxville.
AN INVESTIGATION OF THE CHATTANOOGA BLACK SHALE OF TENNESSEE AS A SOURCE OF URANIUM. Progress Report [for] January 1, 1956 to June 30, 1956. Paris B. Stockdale. July 1, 1956. 9p. Contract AT-(40-1)-1337. $0.15(OTS).

A report is presented of progress on the studies of the Chattanooga shale to obtain a complete geologic picture of the Chattanooga shale in the outcrop area of the Eastern Highland Rim and Northern Highland Rim of Tennessee and in a small area of adjoining Kentucky, with especial emphasis upon stratigraphic relationships and associated special problems, and their implications in turn upon the age and manner of origin of the sediments and upon the origin, source, and distribution of the uranium in the shale. Both field and laboratory studies have been involved. (auth)

10166 TEI-590
Geological Survey.
GEOLOGIC INVESTIGATIONS OF RADIOACTIVE DEPOSITS. Semiannual Progress Report [for] June 1 to November 30, 1955. Dec. 1956. 347p. $1.50(OTS).

Progress during the six-months period from June 1 to November 30, 1955 on investigations of radioactive materials in the United States and Alaska is reported. The program has been directed to an increasing extent toward the understanding of geologic conditions favorable for the concentration of uranium, rather than the search for minable deposits as such. This shift in emphasis is reflected in the decreased amount of exploration drilling during the period, and the accompanying increase in geologic programs of a long-range nature. The program is now directed toward a comprehensive understanding of the many factors involved in uranium geology, and the publication of reports that will make available information on all phases of the uranium program. The field work included a study of U in sandstone type deposits in and outside the Colorado Plateau, in veins, igneous rocks, and related deposits. Uranium in carbonaceous rocks, phosphate, natural waters, and placer deposits was explored. Methods of analytical service and research are discussed. (auth)

10167 AERE-Lib/Trans-757
NEW DATA ON THE ISOTOPIC COMPOSITION LEAD SAMPLES. A. P. Vinogradov and S. I. Zykov. Translated by S. Botcharsky from Doklady Akad. Nauk S.S.S.R. 105, 126-8(1955). 5p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 10-2068.

10168
STUDY OF RADIOACTIVITY IN MODERN STREAM GRAVELS AS A METHOD OF PROSPECTING Randall T. Chew, III. U. S. Geol. Survey Bull. 1030-E, 149-69(1956). $0.25(GPO)

Traverses along some streams of the Colorado Plateau in areas known to contain minable uranium deposits show that anomalous radiation in the stream gravels can be detected with a suitable counter downstream from the deposits. Intensity of radiation is influenced by the size of the uranium deposit, the size of the drainage area of the stream, the grain size of the sediments, and the lithology of the rocks over which the stream flows. The spacing of the stations where readings are taken is controlled by the size of the stream, and special readings are also taken just downstream from important tributaries. An anomaly is empirically defined as a 10 percent rise over background. Radioactive material from large uranium deposits has been detected as much as 1 mile downstream. Radioactive material from smaller deposits is detectable over shorter distances. The method is slow but appears to be a useful prospecting tool under certain conditions. (auth)

10169
X-RAY POWDER DATA FOR URANIUM AND THORIUM MINERALS. Clifford Frondel, Daphne Riska, and Judith Weiss Frondel. U. S. Geol. Survey Bull. 1036-G, 91-153 (1956). $0.25(GPO)

X-ray powder spacing data are given for 67 uranium and thorium minerals. The spacing data and line intensities are given for each mineral and also in the form of a determinative table based on the three most intense lines for each mineral arranged in order of decreasing spacing. (auth)

10170
GEOLOGY OF THE JOHNSON CREEK QUADRANGLE, CARIBOU COUNTY, IDAHO. R. A. Gulbrandsen, K. P. McLaughlin, F. S. Honkala, and S. E. Clabaugh. U. S. Geol. Survey Bull. 1042-A, 1956. 23p. and 2 illus. $0.75 (GPO).

The Johnson Creek 7½-minute quadrangle in southeastern Idaho has been mapped at a scale of 1:24,000. The quadrangle is in the southeastern Idaho region in which Phosphoria formation contains some of the richest and thickest phosphate deposits of the western field. Principal

efforts have been devoted to a detailed definition of structural features. Most of the area of the quadrangle is occupied by the northwestward-trending Aspen Range that is bounded on the west by Bear River valley and on the east by Slug Creek valley. The quadrangle contains only sedimentary rocks and these range in age from Mississippian to Triassic and from Tertiary to Recent. Formations present are the Brazer limestone of Mississippian age, the Wells formation of Pennsylvanian and Permian (?) age, the Phosphoria formation of Permian age, and the Dinwoody and Thaynes formations of Triassic age. Rocks of Tertiary and Quarternary age are present also but have not been designated by formation names. The Johnson Creek syncline and the Aspen Range anticline are the principal structural features of the quadrangle. Phosphate rock is the only important mineral resource at this time. It occurs as bedded rock at different levels in the Phosphoria formation. There are two principal zones of economic importance: one, about 20 ft thick, is near the base of the formation, the other, about 5 ft thick, is 100 to 150 ft above the lower zone. Though the phosphate zones appear to be continuous over the region as a whole, their grade and thickness differ from place to place. (auth)

10171

AIRBORNE AND GROUND RECONNAISSANCE OF PART OF THE SYENITE COMPLEX NEAR WAUSAU, WISCONSIN. R. C. Vickers. U. S. Geol. Survey Bull. 1042-B, 25-44(1956). $0.15(GPO).

Twelve radioactive mineral localities were found as a result of airborne and ground reconnaissance for radioactive minerals in part of the syenite complex near Wausau, Marathon County, Wis. The rocks in the area are of Precambrian age and consist of syenite and nepheline syenite, which have intruded older granite, greenstone, quartzite, and argillite. Outcrops are few, and much of the rock is deeply weathered and covered by residual soil. Thorium-bearing zircon pegmatite float was found within the area of syenite and nepheline syenite at 4 localities. Reddish-brown euhedral to subhedral crystals of well-zoned zircon (variety cyrtolite) comprise more than 40 percent of some specimens. The radioactive mineral at 4 localities outside the area of syenites was identified as thorogummite, which occurs as nodular masses in residual soil. Alinement of the thorogummite float and associated radioactivity suggests that the thorogummite has resulted from weathering of narrow veins or pegmatites containing thorium-bearing minerals. Unidentified thorium-bearing minerals were found at 3 localities, and a specimen of allanite weighing about 2 pounds was found at 1 locality. Shallow trenches at two of the largest radioactivity anomalies showed that the radioactive material extends down into weathered bedrock. The occurrences might warrant additional exploration should there be a sufficient demand for thorium. (auth)

10172

ORIGIN OF URANIUM DEPOSITS. V. E. McKelvey, D. L. Everhart and R. M. Garrels. Econ. Geol. 50, 464-533 (1955).

Uranium is concentrated in certain silicic and silica-alkalic igneous rocks, pegmatites, veins, lenticular sandstones and conglomerates, low-rank high-ash coals, asphaltic materials, marine black shales, and phosphorites. Its distribution in igneous rocks, pegmatites, and veins shows its tendency to concentrate in late stage differentiates. In the granitic rocks, uranium occurs mainly as a minor constituent of accessory minerals that have cations (such as rare earths, thorium, and calcium) for which uranium can substitute isomorphously, but it also occurs as an acid-soluble interstitial constituent. In pegmatites, uranium occurs both in uraninite and in other uranium minerals in combination with niobium, thorium, and rare earths. Uranium is found in both high-temperature veins, where it is mainly in the titanium minerals davidite and brannerite, and low-temperature veins, where it is mainly in pitchblende, the botryoidal variety or uraninite, and coffinite. The low-temperature veins are of several over-lapping types, but all are characterized by sulfides and many contain disseminated iron oxide. Whereas thorium is associated with uranium in igneous rocks and pegmatites, it is rare in the vein deposits of uranium. This separation may be accomplished by oxidation of U^{+4} at a late magmatic stage to $(UO_2)^{+2}$ in which form it is carried away from the unoxidizable Th^{+4}. Subsequently $(UO_2)^{+2}$ is reduced and deposited as pitchblende along with sulfides and other low-valent minerals in veins. The sandstone uranium deposits resemble the pitchblende veins in their mineralogic assemblage except that many of the sandstone deposits also contain vanadium, a metal not abundant in veins. Isotopic studies indicate that the Colorado Plateau deposits are epigenetic and suggest that the uranium was derived from a deep-seated source. The uranium in coal and associated carbonaceous shale beds occurs in the form of metallo-organic compounds but secondary uranium minerals like meta-autunite are found in coals that contain more than 0.1% uranium. The uranium in marine black shales and phosphorites was derived from sea water. The precipitation of uranium in the shales probably is brought about by chemical adsorption by living or dead plankton, but reduction evidently plays an important role in its precipitation and stabilization in the shale. Uranium in the phosphorites substitutes for calcium in the apatite structure. Its adsorption by apatite is hindered by abundance of calcium ions, with which it competes for positions in the structure, and by carbonate and hydroxyl ions, which compete with phosphate groups for structure positions and form less stable compounds with uranium. (auth)

10173

CONTRIBUTIONS TO THE GEOLOGY OF URANIUM AND THORIUM BY THE UNITED STATES GEOLOGICAL SURVEY AND ATOMIC ENERGY COMMISSION FOR THE UNITED NATIONS INTERNATIONAL CONFERENCE ON PEACEFUL USES OF ATOMIC ENERGY, GENEVA, SWITZERLAND, 1955. Lincoln R. Page, Hobart E. Stocking, and Harriet B. Smith, comps. U. S. Geol. Survey Profess. Paper 300, 1956. 739p., 3 illus.

10174

MINERAL COMPOSITION OF GUMMITE. Clifford Frondel (Harvard Univ., Cambridge, Mass. and U. S. Geological Survey, Washington, D. C.). Am. Mineralogist 41, 539-68(1956) July-Aug.

The name gummite has been widely used as a generic term to designate fine-grained yellow to orange-red alteration products of uraninite whose true identity is unknown. A study of gummite specimens from world-wide localities has been made by x ray, optical, and chemical methods. It proved possible to identify almost all of the specimens with already known U minerals. (J.E.D.)

10175

THE Sc ABUNDANCE MINIMUM IN CHONDRITES AND THE NEUTRON EXCESS OF PRINCIPAL ISOTOPES. L. H. Ahrens (Oxford Univ., England). Geochim. et Cosmochim. Acta 9, 273-8(1956) June.

Conspicuous abundance minima in chondrites at Z = 21 (Sc), Z = 22 (Ti), and possibly Z = 31 (Ga) may be correlated with discontinuities in the neutron-excess variation of principal isotopes of the elements. Some of these discontinuities are clearly related to well-established magic numbers (20 and 82, for example), but others are not. (auth)

10176

NEW DETERMINATIONS OF THE AGE OF THE BOB INGERSOLL PEGMATITE, KEYSTONE, S. DAKOTA. G. W. Wetherill, G. R. Tilton, F. L. Davis, and L. T. Aldrich (Carnegie Institution of Washington, D. C.). Geochim. et Cosmochim. Acta 9, 292-7(1956) June.

Age determinations have been made on various minerals from the Bob Ingersoll pit No. 1. The uranium-lead ages agree at 1600 m.y.; Rb-Sr ages of microcline, muscovite, and lepidolite are all about 2050 m.y., probably indicating that the currently accepted Rb decay-constant is incorrect. K-A ages of the micas are in fairly good agreement with U-Pb ages when a K^{40} branching ratio of 0-100 is used. The K-A age of the microcline is definitely lower, probably indicating loss of argon from this mineral. (auth)

10177

DEPOSITS AND THE AGE OF BAS-CAVALLY URANINITES. Jacques Bernazeaud, Arnold Grimbert, Bertrand Lazard, Raoul Roth, and Henri Sanselme. Compt. rend. 242, 1744-6(1956) June 4. (In French)

METALS AND METALLURGY

10178 AD-71689

Republic Steel Corp. Metallurgical Lab., Canton, Ohio.

INVESTIGATION OF THE HIGH TEMPERATURE PROPERTIES OF THE HS 88 AUSTENITIC ANALYSIS PRODUCED WITH FOUR SPECIFIED MODIFICATIONS IN COMPOSITION. S. W. Poole, J. E. Fogarty, and D. C. Bardine. June 29, 1955. 23p. Contract AF-33(616)-178.

A study was made of the effect of composition modifications on notch toughness of a base analysis containing from 11 to 14% Cr and from 13 to 17% Ni(HS 88). The base composition was modified by varying the additions of Mo, Co, W, Ti, B, Al, and N. Tensile, stress rupture, and weld tests were conducted on the alloy compositions. Stress rupture data indicated that all modifications were notch tough when the solution was annealed at 2100°F for 2 hr and followed by a 25% hot-cold-work reduction at 1325°F and by a subsequent stress relieving treatment at 1200°C for 4 hr. Notched and unnotched specimens of modifications-A (0.6% Ti, 0.03% B, 0.03 to 0.07% Al) and B (0.6% Ti, 0.07% B, 0.03 to 0.07% Al) exhibited better stress rupture properties than modifications C (0.6% Ti, 0.13% B, 0.03 to 0.07% Al) and D (no Ti or Al added, 0.07% B). Modification D exhibited the shortest stress rupture life in all unnotched tests. The absence of Ti and Al in modification D indicated that these elements as well as B are necessary to develop superior stress rupture properties in modified HS 88. In general, a 2100°F solution annealing temperature provided better tensile and stress rupture properties with no indication of notch sensitivity than a 1775°F temperature. (See also AD-40 848). (ASTIA abst.)

10179 AD-73280

Massachusetts Inst. of Tech., Cambridge. Lubrication Lab.

STUDY OF FRICTIONAL PROPERTIES OF TITANIUM AT HIGH TEMPERATURES. Final Report. E. Rabinowicz and E. P. Kingsbury. Sept. 1, 1955. 13p. Project TB5-1510. Contract DA-19-020-ORD-3471.

An apparatus which is capable of introducing and measuring frictional forces in a controlled environment above room temperature was constructed. The machine was used to measure friction coefficients at temperatures approaching 1000°C. The curve of friction coefficient vs temperature for Ti surfaces was established under several sliding conditions; liquid lubricants were checked at different temperatures; and an oxide film produced on hot Ti was evaluated. Tests were run with a hemispherically ended Ti rider sliding over Ti plate under a 1085-g normal load and a 5-cm/sliding velocity. Each run was at constant temperature in air with no lubrication and lasted for 450 rev over flat plate. The resulting friction coefficient is plotted against the number of revolutions. At 290°C, the friction coefficient was initially high and dropped gradually to a value below that at room temperature; the friction damage was large. At 490°C, the high initial coefficient was observed and was followed by a rapid drop to below the room temperature value; large surface damage was again noted. At 755°C, the high value was missing, and the curve was practically constant. Tests which were run at room temperature on the film produced at 755°C with and without lubrication indicated that a short heat treatment of Ti in air to moderately high temperatures will allow cheap and effective lubrication at ordinary temperatures with ordinary lubricants by producing a hard surface layer with favorable adsorption properties. (ASTIA abst.)

10180 AD-90749

Mallory-Sharon Titanium Corp., Niles, Ohio.

TITANIUM PROJECT. Progress Report for the Period November 1-December 31, 1955. Report No. 3 (Research Report No. 1000R112). Charles B. Dittmar and G. William Bauer. Jan. 10, 1956. 7p. Contract NOas-54-370-c.

The impact behavior of the 3Mn Complex and 6Al-4V Ti alloys at two interstitial levels is being determined over the temperature range -100 to 1000°F. The data on the 6Al-4V Ti heats show that there is no significant difference in the impact strength of the two interstitial levels (106 and 138 BHN sponge, base material) over the temperature range -100 to 1000°F in either annealed or heat treated (quenched and aged) conditions. Data on the 3Mn Complex alloy (138 BHN sponge, base material) show lower impact strength, in the heat treated condition, than the 6Al-4V alloy at the same interstitial and strength level. (auth)

10181 AERE-Inf/Bib-103

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

BIBLIOGRAPHY ON THE BRAZING OF MILD STEEL. G. L. Cooper. June 1956. 5p.

Selected references on the brazing of mild steel was taken from the literature which has appeared in the last ten years. Some general references are given in Section 1. Section 2 contains the more specific references. The references are arranged alphabetically by author. Brief explanatory notes are included in parenthesis where it is thought necessary to supplement the title. (auth)

10182 AERE-M/R-1974

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE FORMATION OF URANIUM AND BERYLLIUM ALLOYS BY THE SOLID-STATE SINTERING OF MIXED ELEMENTAL POWDERS. J. Williams and J. W. S. Jones. June 7, 1956. 27p.

Large volume expansions accompany the formation of binary alloys of Be with U, Th, Fe, Cu, Zr, Ti, V, and U with Al during sintering of the mixed elemental powders. No expansions are detected when sintering binary mixtures of Be with Al, Mg and Si or of U with Zr, Mo, Fe, Ni, Mn, Cr and C. The expansions are anisotropic, being greatest in the direction of cold-compacting; the degree of anisotropy is a function of the metals used and of the composition of the compact. Maxima occur in all the composition vs. expansion graphs determined. The magnitude of the maximum is a function of compact shape and particle size, the composition corresponding to this maximum remaining sensibly unaffected by these variables. These experimental observations together with those of other investigations

can be satisfactorily interpreted on the hypothesis that the volume expansions are due to the formation of diffusional porosity during sintering. The practical significance of the results and methods for minimising and circumventing the expansion are discussed. (auth)

10183 BM-RI-5265
Bureau of Mines.
PRODUCTION OF TITANIUM CASTINGS. R. A. Beall, F. W. Wood, J. O. Borg, and H. L. Gilbert. Oct. 1955. 45p.

A review of the program for developing a method for producing Ti castings is presented. Two methods of metal transfer have been investigated, bottom-tapping and over-the-lip pouring. Owing to the inherent uncertainty in essential controls in the bottom-tapping equipment, the over-the-lip technique was determined to be the superior method. A number of castings were produced that are satisfactory as regards metal contamination and mold reproduction. However, the problems of mold design have yet to be solved in order to achieve perfectly sound castings. The potential production rate of over-the-lip equipment is reasonable from an industrial viewpoint, and the capacity will permit pouring castings of useful sizes. (auth)

10184 CF-54-6-248
Oak Ridge National Lab., Tenn.
[ATTACHED RÉSUME OF "INCIDENTS."] E. G. Bohlmann. June 29, 1954. 1p. $1.80(ph OTS); $1.80(mf OTS).

With this is bound, with separate paging: Mathieson Chemical Corp., Baltimore. CA-96—TITANIUM IN NITRIC ACID: "EXPLOSIONS." B. J. Philibert. Apr. 7, 1954. 3p.

A brief review is given of reports available on explosions caused by the reaction of Ti in HNO_3. (J.E.D.)

10185 EES-040029F
Naval Engineering Experiment Station, Annapolis.
HIGH TEMPERATURE PROPERTIES OF UNILOY 19-9DX ALLOY. W. Lee Williams. Aug. 3, 1954. 13p. (AD-77085).

The tensile, creep and stress-rupture properties of 19-9DX alloy were investigated briefly over the range of 1100 to 1500°F. The alloy was tested in two conditions: hot rolled-stress relieved and solution treated-aged. The properties were such that the Nb-free 19-9DX alloy could be substituted in most applications for Nb-bearing 19-9DL alloy. (auth)

10186 ISC-743
Ames Lab., Ames, Iowa.
PREPARATION OF INGOTS OF URANIUM—NIOBIUM ALLOY. O. N. Carlson, N. Ida, D. Peterson, F. Tate, and H. S. Wilhelm. July 13, 1956. 9p. Contract W-7405-eng-82. $0.15(OTS).

Homogeneous ingots of uniform composition of U—Nb alloy were prepared by the co-reduction of UF_4 and Na_2NbOF_5 with Ca. Fifteen pounds of alloy were melted in BeO and cast into a graphite mold. High yields and good metal slag separations were obtained. Chemical analysis and density determinations showed the composition to be 10 ± 0.5 wt. % Nb. (F.S.)

10187 JPL-PR-20-207
California Inst. of Tech., Pasadena. Jet Propulsion Lab.
PRELIMINARY STUDY OF THE TITANIUM—CERIUM SYSTEM. Progress Report. Jack L. Taylor. Feb. 11, 1954. 16p. Contract DA-04-495-ORD-18.

The phase diagram of the Ti—Ce system is of the peritectic type. The solubility of Ce in beta Ti near the peritectic temperature is less than 1%, and the solubility in alpha Ti decreases with temperature and is less than 0.19% at 750°C. No intermetallic compounds were found between 0 and 50% Ce. Small Ce additions reduce the grain size of some commercially available Ti alloys. (auth)

10188 NACA-TM-1419
Aluminum Co. of America. Aluminum Research Labs., New Kensington, Penna.
EFFECTS OF INTERMITTENT VERSUS CONTINUOUS HEATING UPON THE TENSILE PROPERTIES OF 2024-T4, 6061-T6, AND 7075-T6 ALLOYS. G. W. Stickley and H. L. Anderson. Aug. 1956. 7p.

The object of these tests was to determine the effects of intermittent and continuous heating at 300 and 400°F, for total periods of 100 and 200 hr, upon the tensile properties of 2024-T4 and 6061-T6 alloy rolled-and-drawn rod and 7075-T6 alloy extrusions, at room temperature and at the temperature of heating. The effects of intermittent heating were found to be cumulative and the same as for continuous heating. (auth)

10189 NACA-TN-3755
California Inst. of Tech., Pasadena.
SOME OBSERVATIONS ON THE RELATIONSHIP BETWEEN FATIGUE AND INTERNAL FRICTION. S. R. Valluri. Sept. 1956. 42p.

Results are presented of an investigation made to determine the internal friction and fatigue strength of commercially pure 1100 aluminum under repeated stressing in torsion at various temperatures and stress levels in an effort to find if there exists any correlation between internal friction and fatigue characteristics. (auth)

10190 NP-6080
Clevite Research Center, Cleveland.
RESEARCH ON THE LUBRICATION OF TITANIUM. Quarterly Progress Report No. 2 [for] May 15, 1956 to August 14, 1956. Patricia H. Moyer. 34p. Project 50167 G. Contract AF33(616)-3350.

Titanium is highly susceptible to galling and seizure. Past efforts to reduce this tendency have uncovered special lubricants and surface treatments. This investigation seeks to elucidate the role of the oxide film on titanium, to obtain some information about the frictional properties of modified titanium coatings, and to make a direct comparison of the wear resistance of the best surface treatments in the presence of various lubricants using equipment generally acceptable for wear tests under conditions of boundary lubrication. During this report period, a study was carried out on the stick-slip behavior of untreated, nitrided, anodized, and fluorided titanium in the presence and absence of lubricants. It was concluded that under ordinary conditions, the oxide layer on untreated titanium is thin and ineffective. The nitrided coating was the most wear resistant. Stick-slip was rather unexpectedly found to occur in the presence of lubricants. Preliminary experiments were carried out on the Shell four-ball wear tester, using steel and brass balls. (auth)

10191 NP-6085
Metallurgical Advisory Committee on Titanium.
MINUTES OF FOURTH MEETING OF PANEL ON METHODS OF ANALYSIS OF THE METALLURGICAL ADVISORY COMMITTEE ON TITANIUM AT HOTEL NEW YORKER, NEW YORK, NEW YORK, MAY 24—25, 1956. S. Vigo. June 29, 1956. 22p.

Results of group studies and techniques used in chemical, spectrographic, and vacuum fusion methods of Ti analysis are briefly reported. (F.S.)

10192 NOTS-TM-1939
Naval Ordnance Test Station, Inyokern (China Lake), Calif.
GUIDE TO ELECTRODEPOSITED COATINGS AND OTHER SURFACE TREATMENTS FOR METALS. D. E. Couch and J. W. Hensley. Sept. 24, 1954. 30p. (AD-81707).

A handbook for engineers is given describing the properties and use of electrodeposited metals and other electrochemical and chemical treatments useful in metal finishing. (T.R.H.)

10193 NRL-4763
Naval Research Lab., Washington, D. C.
ONSET OF FAST CRACK PROPAGATION IN HIGH STRENGTH STEEL AND ALUMINUM ALLOYS. G. R. Irwin. May 24, 1956. 17p. Project No. NR 631-030. (PB-121224).

The concept of driving force per unit crack front or the "force tendency" is discussed. This is a more general and more readily useful concept than the Griffith theory in that it does not require the assumption of the absence of plasticity and there is no complication involving fixed grips. It is shown that the force tendency "C" exists for any stress condition and that it can be determined from strain measurements near the crack head. Various formulae for C are given and the case of hydrogen embrittlement is discussed. (auth)

10194 ORNL-2147
Oak Ridge National Lab., Tenn.
THE SAMPLING OF ALKALI METAL SYSTEMS WITH THE MODIFIED MSA SAMPLER. G. Goldberg, A. S. Meyer, Jr., and J. C. White. Sept. 10, 1956. 17p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

Two significant modifications have been made to the MSA alkali metal sampler: 1) the substitution of vacuum-tight, modified Wilson seal for the packing gland, and 2) the replacement of the gate valve with a vacuum-tight Teflon-packed, Jamesbury valve. A complete description of the modified sampler and a stepwise procedure for its application to the sampling of dynamic or static systems of alkali metals are given. (auth)

10195 SM-205
Australia. Aeronautical Research Labs., Fisherman's Bend, Victoria.
A COMBINED DILATOMETER-ELECTRICAL RESISTIVITY APPARATUS FOR INVESTIGATING THE SINTERING OF METAL POWDER COMPACTS. N. A. McKinnon. Apr. 1953. 24p. (AD-73667).

An apparatus to measure the changes in linear dimensions and electrical resistivity of pressed compacts of metal powders during sintering is described. The usefulness of this apparatus has been shown by some investigations into the sintering of copper, aluminum and aluminum alloys. (auth)

10196 TID-3304
Technical Information Service Extension, AEC.
ZIRCONIUM: A BIBLIOGRAPHY OF UNCLASSIFIED REPORT LITERATURE. July 1956. 43p. $0.30(OTS).

This bibliography contains 225 annotated references to unclassified reports on zirconium. References are included to reports written prior to September 1955. Author, subject, and report number indexes are provided. (auth)

10197 WADC-TR-54-175(Pt. 2)
Michigan. Univ., Ann Arbor. [Engineering Research Inst.]
NOTCH SENSITIVITY OF HEAT-RESISTANT ALLOYS AT ELEVATED TEMPERATURES. PART 2. ANALYSIS OF NOTCHED-BAR RUPTURE LIFE IN TERMS OF SMOOTH-BAR PROPERTIES. [Period covered] January 1954 to December 1954. Howard R. Voorhees and James W. Freeman. Jan. 1956. 86p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: DESIGN DATA FOR METALS. Contract AF 18(600)-62. (PB-121184).

Rupture lives of smooth and notched bars were compared in tests of three heat-resistant alloys with conventional heat treatments. Additional rupture tests were run for two of the alloys using notched and smooth specimens from material cold rolled between solution and aging treatments. The method of notch preparation was demonstrated to have a large effect on notched-bar life for some conditions. Variable results were attributed to residual stresses remaining from the machining operation. Other experimental data obtained on smooth bars for the same alloys and conditions included short-time tensile properties, creep curves, relaxation characteristics, and rupture life when the stress was changed from one level to another during the test. A definite qualitative agreement was noted between notch strengthening or weakening and the rate of experimental stress relaxation under creep conditions. A quantitative stepwise analysis was developed to compare notch rupture behavior with properties of smooth bars. Calculation steps in the proposed analysis are summarized. Completed calculations for one condition of notch strengthening and one of notch weakening showed satisfactory agreement with experimental findings and indicates that stress redistribution by creep-relaxation could by itself explain the wide differences in notch behavior observed for different materials and test conditions. (auth)

10198 WADC-TR-54-598
Horizons, Inc., Cleveland.
RETAINER MATERIALS FOR AIRCRAFT GAS TURBINE BEARINGS. Eugene J. Bucur, F. Clifton Wagner, and John T. Burwell, Jr. Mar. 1955. 52p. Project title: GAS TURBINE TECHNOLOGY. Task title: BEARING MATERIALS. Contract AF33(616)-2099. (AD-74305)

A study of the elevated temperature wear resistance of potential cage materials for aircraft turbojet bearings was conducted using a special wear testing machine to simulate roughly the conditions to which such bearings are subjected in service. Several alloy compositions have been developed which have superior bearing properties to "S" Monel and iron-silicon bronze. All of the promising materials except one contain silver as a major alloying element. It has been established that the addition of from 2 to 4% silicon is distinctly beneficial to the wear properties of several classes of metallic alloys. It has been shown that the alloy composition can be varied considerably with respect to the strong, load supporting phase as long as silver is contained in the soft matrix. (auth)

10199 WADC-TR-55-103(Suppl. 2)
Syracuse Univ., N. Y.
DESIGN PROPERTIES OF HIGH-STRENGTH STEELS IN THE PRESENCE OF STRESS-CONCENTRATIONS. EFFECTS OF A NUMBER OF VARIABLES ON THE MECHANICAL PROPERTIES OF AIRCRAFT HIGH-STRENGTH STEELS. [Period covered] March 1954–June 1955. B. B. Muvdi, E. P. Klier, and G. Sachs. Jan. 1956. 115p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: DESIGN AND EVALUATION DATA FOR STRUCTURAL METALS. Contract AF33(616)-2362. (PB-121155).

Individual and average test values for tension, notch-tension, impact, fatigue, and notch-fatigue for nine high strength steels are tabulated. (F.S.)

10200 WADC-TN-55-404
Case Inst. of Tech., Cleveland.
HYDROGEN EMBRITTLEMENT AND STATIC FATIGUE IN HIGH STRENGTH STEEL. R. D. Johnson, H. H. Johnson, W. J. Barnett, and A. R. Troiano. Aug. 1955. 40p. Project title: METALLIC MATERIALS. Task title: SUPPORTING RESEARCH ON HIGH STRENGTH STEELS FOR AERONAUTICAL APPLICATIONS. Contract AF33(038)-22371. (PB-121064)

The strength level dependence and the temperature

dependence of the static fatigue phenomenon were determined. Static fatigue at ambient temperature became significant at strength levels above 180,000 psi for the testing conditions employed. The temperature dependence of the delayed failure time indicated that the crack propagation was controlled primarily by the inward diffusion of H. A secondary influence of the applied stress on the rate of crack propagation was evident from the change in the slope of the static fatigue curve as a function of testing temperature. The initial embrittlement introduced by Cd plating, either commercial or laboratory, was comparable in magnitude to that introduced by standard H charging conditions. Cd plating had a powerful influence in delaying recovery. Upon aging, the H distribution in Cd plated specimens changed from a localized surface concentration to a uniform distribution at a concentration sufficient to produce substantial embrittlement. (auth)

10201 WADC-TR-56-99

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

MECHANICAL PROPERTY, CORROSION AND WELDING STUDIES ON 6066 ALUMINUM ALLOY. [Period covered] September 1954 to September 1955. John D. Wood. June 1956. 35p. Project title: METALLIC MATERIALS. Task title: ALUMINUM AND ALUMINUM ALLOYS.

The mechanical properties and stress corrosion characteristics of 6066-T6 extrusion were studied. The effect of salt spray exposure on 6066-T6 sheet was determined and found to approach 2014-T6 alloy. In addition, the welding characteristics of 6066 were investigated and it was found that 6066 alloy can be arc welded using 6066, 716 and 195 alloy filler metals. (auth)

10202 WADC-TR-56-121

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

THE COMBINED EFFECTS OF CARBON, OXYGEN, NITROGEN AND HYDROGEN ON THE PROPERTIES OF TITANIUM SHEET WELDMENTS. [Period covered] September 1953 to December 1955. John F. Rudy. June 1956. 43p. Project title: METALLIC MATERIALS. Task title: WELDING AND BRAZING OF TITANIUM.

Four series of interstitial alloys were melted and rolled into sheet. The first series contained three levels of H ranging up to 0.063 wt. %. The second series contained three levels of the elements O and C combined, ranging up to 0.200% O and 0.239% C. The third series contained O and N in three levels ranging up to 0.166% O and 0.120% N. The fourth series contained N and H in three levels ranging up to 0.102% N and 0.088% H. In addition to these alloys, a base metal ingot which contained no intentional addition was also melted and rolled into sheet. Inert gas shielded arc welds were made in $\frac{1}{8}$ in. sheets of each of the thirteen alloys. The physical properties of these alloys were determined by bend tests, tensile tests, impact tests, hardness measurements and metallographic observations for both the welded and unwelded material. These data will aid in establishing maximum allowable combined percentages of C, O, N, and H for weldable Ti sheet. (auth)

10203 WADC-TR-56-146

New York Univ., New York.

PROPERTIES OF ACTIVE EUTECTOID TITANIUM ALLOYS. [Period covered] January 1, 1955 to January 31, 1956. R. F. Bunshah and H. Margolin. June 1956. 71p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF33(616)-2766.

The microstructure and mechanical properties of Ti-5Cu-3Al, Ti-8Cu-3Al, Ti-5Cu-3Al-2Sn and Ti-8Cu-3Al-2Sn alloys were studied. Room-temperature and elevated-temperature properties are quite comparable to those of annealed commercial alloys. A stable alpha-plus-compound structure shows the best combination of strength and ductility. In order to obtain highest ductility it is necessary to avoid long semi-continuous paths of compound. T-T-T curves and microstructural observations are presented. Microstructure and mechanical properties of binary Ti–Ni alloys were investigated. They are quite similar to those of binary Ti–Cu alloys. In line with some recent work on steel, nickel and zinc, some preliminary data on a binary Ti-2Cu alloy show a considerable increase in the strength of this alloy without loss of ductility, by a suitable prestrain and anneal treatment. The strengthening may be attributed to subboundaries produced thereby. (auth)

10204 WADC-TR-56-190

Mallory (P. R.) and Co., Inc. Metallurgical Research Lab., Indianapolis.

A STUDY OF THE POSSIBILITY OF REINFORCING HIGH-TEMPERATURE ALLOYS BY ADDITION OF REFRACTORY POWDERS. [Period covered] April 1955 to April 1956. John D. Burney. Apr. 18, 1956. 41p. Project title: CERAMIC AND CERMET MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF33(616)-2959.

A study of the possibility of reinforcing 80 Ni–20 Cr alloy by the addition of such refractory oxides as Al_2O_3, TiO_2, ZrO_2, Cr_2O_3 and SiO_2 was made. Powder metallurgical fabrication techniques investigated were pressing and sintering, pressing, sintering and repressing, pressing, sintering followed by hot working, hot pressing and liquid phase sintering. In the "press-sinter" method of fabrication, bars with 1.0% TiO_2 showed better stress-rupture properties than bars with any of the other oxide additions investigated. Rupture times were 7.45 and 8.7 hours at 1600°F and 7000 psi. Hot forging techniques were found to be applicable for working bars containing oxide additions of 1.0% or less. An 80 Ni–20 Cr alloy reinforced with 1% Al_2O_3 and densified by a liquid phase sintering technique resulted in improved stress-rupture properties compared to wrought 80 Ni–20 Cr alloy. This material had a rupture life at 1600°F and 7000 psi in excess of 268 hours; while at 1800°F and 6650 psi, the rupture life was almost 47 hours. The room temperature impact and ultimate tensile strength appeared adequate and the oxidation resistance and thermal shock properties were good. (auth)

10205 WAPD-CP-622

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

PRELIMINARY REPORT ON STATUS AND EVALUATION OF CARBON STEEL. Hugh F. Beeghly. [1954]. Changed from OFFICIAL USE ONLY Nov. 22, 1955. 40p. $0.30(OTS).

Report on status and evaluation of C steel for development as a replacement for the more expensive stainless steels used in reactor primary system components is presented. (auth)

10206 AEC-tr-2556

APPLICATION OF RADIOACTIVE METHODS TO METALLURGICAL PROBLEMS (AUTORADIOGRAPHY). G. Glawitsch. Translated from Z. Metallkunde 47, 199-202 (1956). 14p.

By inclusion of a suitable isotope into metal samples, by preparation of plane surfaces and subsequent contact with suitable photographic materials, it is possible to determine the distribution of the isotope and consequently also that of its fundamental element. The high velocity of the radiation particles occurring during nuclear decay (α and β particles), furthermore the nature of the photon radiation

(γ-radiation) result in a certain range in the material and therefore cause blackenings which are not accurately confined to the location of the radiation source. The limitation of the resolution capacity of autoradiographs can be successfully counteracted by the use of a special autoradiographic technique, i.e. the stripping emulsion method. The resolution capacity then amounts to about 10μ with the use of Ag^{110} as the radiation source which could be proved by the preparation of a Ag^{110}–Bi alloy with a dendritic formation of the silver crystallites. The facts mentioned result in the fundamentals for the manifold application possibilities in metallurgy, an example of which was given by the metal sintering process. Such investigations can be made especially instructive by the choice of the system Ag^{110}–Au as well as by the use of spherical metal powders. (auth)

10207 AERE-Lib/Trans-708

DIFFUSION IN THE BETA-PHASE OF THE SYSTEM SILVER–ZINC. T. Heumann and P. Lohmann. Translated by R. J. R. Richardson from Z. Elektrochem. 59, 849-60(1955). 25p.

The common diffusion coefficients for the β phase in the system Ag–Zn have been determined by Matano's method, together with the partial diffusion coefficients for Ag and Zn from the migration of the welding planes and the mass flow at 400, 470, and 630°C. In addition, the self-diffusion coefficients for the same temperatures were determined using Ag^{110}. The equations required for the calculation were derived and related to Darken's formulas. (auth)

10208

SURFACE TENSION AT ELEVATED TEMPERATURES. III. EFFECT OF Cr, In, Sn AND Ti ON LIQUID NICKEL SURFACE TENSION AND INTERFACIAL ENERGY WITH Al_2O_3. C. R. Kurkjian and W. D. Kingery (Massachusetts Inst. of Tech., Cambridge). J. Phys. Chem. 60, 961-3 (1956) July.

The sessile drop method has been employed to study the surface tension and interface energy of dilute solutions of In, Sn, Cr and Ti in Ni for the system Ni(l)–Al_2O_3(s). The surface tension of pure liquid Ni was found to be 1725 dyne $cm.^{-1}$. Indium and Sn concentrate at the liquid–gas interface, lowering the surface tension; Cr and Ti concentrate at the solid–liquid interface, lowering the interface energy. Adsorption at the solid–liquid interface is closely related to the free energy of metal–oxygen bond formation. (auth)

10209

THE CRYSTAL STRUCTURES AND LATTICE PARAMETERS OF HIGH-PURITY SCANDIUM, YTTRIUM, AND THE RARE EARTH METALS. F. H. Spedding, A. H. Daane, and K. W. Herrmann (Iowa State Coll., Ames). Acta Cryst. 9, 559-63(1956) July.

The crystal structures and accurate lattice constants of scandium, yttrium and the rare earth metals are given, and the values of their calculated mole-atomic volumes, densities, axial ratios and metallic radii are graphically compared. Expected variations due to the 'lanthanide contraction' and structure differences are noted, and additional irregularities in the axial ratio and metallic radii plots are indicated. (auth)

10210

EFFECTS OF MANGANESE, CHROMIUM, AND VANADIUM ON THE SURFACE TENSION OF LIQUID IRON. T. P. Kolesnikova and A. M. Samarin. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk, 63-9(1956) May. (In Russian)

The method of maximum pressure in gaseous bubbles was used in determination of the surface tension in iron fusion with Mn, Cr, and V. The relation between O_2 content, the surface tension, and non-metallic impurities were investigated. The results showed that manganese oxide lowers the surface tension while combination of Cr with O_2 (up to 2%) and V with O_2 are quite inactive. (R.V.J.)

10211

THE DISTILLATION OF LITHIUM METAL. Leo F. Epstein and W. H. Howland (Knolls Atomic Power Lab., Schenectady, N. Y.). Science 114, 443-4(1951). Oct. 26.

10212

THE BAINITE TRANSFORMATION. R. F. Hehemann and A. R. Troiano (Case Inst. of Tech., Cleveland). Metal Progr. 70, 97-104(1956) Aug.

The microstructural constituent in steel referred to as bainite resulting from austenite transformation is described. The points of similarity between bainite and the more conventional diffusion-controlled pearlite and non-diffusion-controlled martensite modes of decomposition are discussed. (auth)

10213

THE PRODUCTION OF REACTOR FUEL ELEMENTS. II. L. M. Wyatt (U. K. A. E. A., Industrial Group HQ, Risley, England). Nuclear Power 1, 82-8(1956) June.

When uranium metal has been obtained by various processes, it has to be fabricated into fuel elements. This generally commences with high-frequency vacuum casting and the process is described in detail. Further working is then done by rolling or extrusion, using established techniques with modifications. Irradiation in a reactor causes severe distortion and methods have been evolved for minimizing this. The use of alternative forms of fuel elements such as sintered ceramics is discussed and a hydrostatic process is described. (auth)

10214

ZIRCONIUM AND ZIRCALOY II MECHANICAL PROPERTIES. Nuclear Power 1, 94a(1956) June.

10215

TITANIUM. A. D. McQuillan and M. K. McQuillan. New York, Academic Press Inc., 1956. 466p. London, Butterworths Scientific Publications.

The history and occurrence; recovery from ores; purification, melting, and casting of Ti and its alloys; fabrication, joining, and machining and methods of descaling; physical properties, deformation mechanisms and textures; constitution and transformation in Ti and Ti alloys; heat treatment, mechanical properties, and corrosion; and metallographic techniques for Ti and its alloys are discussed. (J.E.D.)

10216

ZIRCONIUM. PART 3. PROPERTIES AND USES. G. L. Miller. Nuclear Eng. 1, 164-8(1956) July.

The low neutron cross-section and good anti-corrosion properties make zirconium an important constructional and cladding material. The main physical and mechanical properties are summarized, corrosion resistance is discussed and some notes given on the alloying of the metal. (auth)

10217

METALLURGY OF URANIUM AND THORIUM. A. Cacciari, R. De Leone, C. Fizzotti, and M. Gabaglio. Energia nucleare (Milan) 3, 154-67(1956) June 15. (In Italian)

The status of U production throughout the world is surveyed. (B.J.H.)

10218

THE USE OF SODIUM AND OF SODIUM–POTASSIUM ALLOY AS A HEAT-TRANSFER MEDIUM. III. W. B. Hall and T. I. M. Crofts (U. K. Atomic Energy Authority, Sellafield). Atomics 7, 271-3 & 290(1956) Aug.

The applications of liquid metals in heat-transfer problems are discussed, and comparisons are drawn between those metals whose melting points are sufficiently low to

make them of interest in this respect. A number of sodium and sodium–potassium circuits which have been built and operated over the past three years are described; some of these were built in order to gain experience in handling the liquid metals, while others were for heat-transfer experiments. A general discussion on the design and construction of liquid metal circuits and the components which are commonly used in them is given. A brief discussion of forced-convection heat-transfer with liquid metals follows, and the results of some work on cavitation in sodium–potassium eutectic flowing through a constriction in a pipe are summarized. The first parts of these articles appeared in the May and June issues of ATOMICS. (auth)

10219

ROOT PASSES IN STAINLESS STEEL WITH NEW INERT-ARC PROCEDURES. E. B. Lavelle (General Electric Co., Richland, Wash.) and L. H. Rasmussen and E. M. Kuchera (J. A. Jones Construction Co., Richland, Wash.). Welding J. (N. Y.) 35, 647-54(1956) July.

The root pass welds in butt joints permit a smooth inner surface on the welds. Considerable latitude of offset and separation is permissible in the joints. Familiarity with the method broadens the ability to successfully join stainless steels with inert–gas–shielded tungsten-arc welding. (F.S.)

10220

THE WELDING OF STEELS FOR HIGH-TEMPERATURE PURPOSES. E. Kauhausen (Metals Research Labs., Niagara Falls, N. Y.). Welding J. (N. Y.) 35, 347s-56s (1956) July.

The analysis of the most important steels for high-temperature applications in power plant, refineries and gas turbines are listed. The welding techniques of these are discussed. (F.S.)

10221

ARC-WELDING TEMPERATURES. R. J. Grosh and E. A. Trabant (Purdue Univ., Lafayette, Ind.). Welding J. (N. Y.) 35, 396s-400s(1956) Aug.

The results of two recent measurements of the quasi-stationary temperature distribution in thick and thin arc-welded stainless steel plates with an analytical study previously reported are compared. The analytical results were obtained for one, two, and three-dimensional heat conduction from a moving plane, line, and point energy source where the thermal properties of the solid are certain functions of temperature. The analytical results are outlined. Excellent agreement is noted between experiment and theory. (auth)

10222

AUTORADIOGRAPHY IN THE STUDY OF SURFACE PHENOMENA. B. Verkerk (Philips Research Labs., Eindhoven, Netherlands). Nucleonics 14, No. 7, 60-4(1956) July.

A technique is described for making surface autoradiographs of metal specimens. (W.L.H.)

10223

ZIRCONIUM — ITS PRODUCTION AND PROPERTIES. U. S. Bur. Mines Bull. 561, 1956. 180p. $1.00(GPO).

Geological occurrences, Mg-reduction process, Zr melting, mechanical properties, fabrication procedures, study of Zr alloys, uses of Zr metal, availability and cost of ductile Zr, and analytical procedures are discussed. (J.E.D.)

10224

THE INTERDIFFUSION OF URANIUM AND ALUMINIUM. A. D. Le Claire and I. J. Bear (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 2, 229-42(1956) June.

Results are given of measurements of the width, as a function of temperature and pressure, of the diffusion zone formed by the interdiffusion of U and Al and of the relative penetration of U into Al and of Al into U. The experiments are unusual among diffusion measurements in showing an appreciable accelerating effect of pressure on the rate of interdiffusion. This is most marked for temperatures below ~540°C. The penetration of the U into the Al is about $2\frac{1}{4}$ times faster than that of the aluminium into the uranium. The results of a microscopical and x-ray examination of the diffusion zone are presented, and a discussion is given of the possible origins of the pressure effect. (auth)

10225

ON THE MECHANISM OF IRRADIATION ANNEALING. R. S. Barnes and M. J. Makin (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 2, 291-8(1956) June.

The nonlinearity of the resistivity/integrated flux curve obtained by Cooper, Koehler, and Marx (1955) during the deuteron bombardment of copper wires at 10°K is considered to be due to a bombardment-induced annealing process quite distinct from the thermal annealing which is observed at higher temperatures. Three possible causes of this irradiation annealing are discussed. The local temperature rise around the track of the incident deuteron (the "thermal spike") is of insufficient extent and duration to permit the observed amount of annealing. The local melting which might occur in displacement spikes also seems insufficient. If, however, an individual knock-on at the end of its track travels, not by itself moving from one interstitial position to the next, but by taking the lattice position of a neighbouring atom, forcing that atom into the neighbouring interstitial position, then the interstitial atom could effectively travel many atomic distances at low speeds, because the energy lost during such movement should be low. The result of such an interstitial atom passing within a critical distance of a stationary vacancy would be mutual annihilation, and a decrease in the resistivity. If this critical distance is three atomic spacings then it is sufficient that the interstitial atom travels about eighteen atomic spacings in the manner described to give the amount of annealing observed in the experiments. (auth)

Refer also to abstract 10288.

PHYSICS

10226 NP-4859(Suppl. 8)

Little (Arthur D.) Inc., Cambridge, Mass.

LOW TEMPERATURE BIBLIOGRAPHY FOR THE FIELD OF CRYOGENICS. Supplement No. 8. Aug. 1956. 10p.

10227 AERE-Lib/Trans-738

CONTRIBUTIONS TO THE KNOWLEDGE OF THE MECHANICS OF SOFT SUBSTANCES. Friedrich Kick and Ferdinand Polak. Translated by F. Hudswell from Dinglers Polytech. J. 224, 465-73(1877). 10p.

The action of compressive forces on soft bodies is discussed. If a cylindrical body of plastic clay, wax, or lead is placed on a horizontal fixed plate and is compressed by means of another plate, displacement or slip of the particles in the bodies occurs. Mathematical equations for calculating the slip are presented. Figures are presented which show the direction of particle slip as related to the pressure applied. (W.L.H.)

10228 AERE-Lib/Trans-739

CONTRIBUTIONS TO THE KNOWLEDGE OF THE MECHANICS OF SOFT BODIES. Friedrich Kick and Ferdinand

Polak. Translated by F. Hudswell from Dinglers Polytech. J. 234, 257-64(1879). 9p.

Data are presented on the flow deformation of soft bodies such as porcelain, paste, clay, bread, and waxes. A means is also presented for determining the mass of a machine (piston) for working or forging soft bodies. (W.L.H.)

10229 AERE-Lib/Trans-740

CONTRIBUTIONS TO THE KNOWLEDGE OF THE MECHANICS OF SOFT BODIES. (Conclusion of the Article on Page 257 of This Volume). Friedrich Kick and Ferdinand Polak. Translated by F. Hudswell from Dinglers Polytech. J. 234, 345-50(1879). 6p.

Impact tests were performed on various substances such as Pb, Cu, and porcelain. Results of these tests are presented. (W.L.H.)

10230

PRELIMINARY REPORT ON THE ISOTOPIC STRUCTURE OF THE CADMIUM PRIMARY STANDARD OF WAVELENGTH. John H. Wise (Washington and Lee Univ., Lexington, Va.) and Kenneth L. Vander Sluis (Oak Ridge National Lab., Tenn.). J. Opt. Soc. Amer. 46, 587-9(1956) Aug.

With enhanced samples of the eight isotopes of cadmium in electrodeless discharge tubes, measurements of the center of gravity line position of λ6438 have been made to better than one part in 25 million or to about 0.0003 A. The estimated resolution, based on Doppler broadening, was 500,000. The observed shifts, compared to a similar normal cadmium source, have been treated by a least squares analysis of a matrix multiplication by the ORACLE. These preliminary results indicate a difference for the extreme masses of about 0.008 A, which is comparable with the half-width of the red line in an atomic beam source. With the exception of mass 108, there is a regular increase in wavelength for the even mass numbers. The odd mass isotopes appear to give anomalous shifts, falling near the shift for the adjacent larger even mass. The principal source of error in the procedure is associated with apparent shifts due to differences in density of the patterns. (auth)

10231

TEMPERATURE CHARTS FOR INTERNAL HEAT GENERATION. M. P. Heisler (Atomics International, Canoga Park, Calif.). Trans. Am. Soc. Mech. Engrs. 78, 1187-92 (1956) Aug.

A number of graphs are presented for determining transient heating effects in simple bodies having uniform internal heat sources. The range of parameters covers Fourier's modulus between 0 and ∞, and relative boundary resistance—also referred to as the inverse Biot or modified Nusselt number—between 0 and ∞. The full range of position variable is covered except for the case of Fourier's modulus less than 0.2. In this case the complete range is covered only for values of relative boundary resistance equal to zero. (auth)

10232

THE VISCOSITY OF STEAM, HEAVY-WATER VAPOR, AND ARGON AT ATMOSPHERIC PRESSURE UP TO HIGH TEMPERATURES. C. F. Bonilla, S. J. Wang, and H. Weiner. Trans. Am. Soc. Mech. Engrs. 78, 1285-9(1956) Aug.

Because of the increasing emphasis on high-temperature processes and high-speed flight, the physical properties of gases at high temperatures and atmospheric pressures have acquired considerable importance. A recent study of the viscosity of steam was carried out over the range of 450 to 1200 deg C in a heat-jacketed apparatus. At that point failure of refractory supports in the furnace precluded higher and lower temperature runs. It was decided to repeat this work with the same type of capillary efflux viscometer but a stronger support for the capillary, and also cover lower and higher temperatures. The viscosity of D_2O vapor, not found in the literature, was also determined. In addition, the viscosity of argon was measured, in view of expressed doubts as to the accuracy of Vasilesco's results. (auth)

10233

DETONATION PHENOMENA IN HOMOGENEOUS EXPLOSIVES. A. W. Campbell, T. E. Holland, M. E. Malin, and T. P. Cotter, Jr. (Los Alamos Scientific Lab., N. Mex.). Nature 178, 38-9(1956) July 7.

10234

THE THEORY OF THERMAL CONDUCTIVITY OF ISOTOPIC SEMICONDUCTORS IN MAGNETIC FIELDS. Otfried Madelung. Z. Naturforsch. 11a, 478-81(1956) June. (In German)

10235

THE QUESTION OF PLASMA VIBRATIONS AND WAVES IN SEMICONDUCTORS. E. Groschwitz and K. Siebertz. Z. Naturforsch. 11a, 482-91(1956) June. (In German)

10236

INDEPENDENT MEASUREMENT OF THE ATOMIC SCATTERING FACTOR AND THE DEBYE FACTOR. Bernard Borie (Massachusetts Inst. of Tech., Cambridge). Acta Cryst. 9, 617-18(1956) July.

A method which allows the determination of the atomic scattering and Debye factors independently of a knowledge of the other from measurements made at one temperature is described. The method is illustrated by applying it to Cu. (auth)

10237

THE BEHAVIOR OF HELIUM II IN THE NEIGHBORHOOD OF A HEAT RADIATING SURFACE. E. L. Andronikashvili and G. G. Mirskaia (Institute of Physics and Institute for Physical Problems, Academy of Sciences, U.S.S.R.). Soviet Phys. JETP 2, 406-9(1956) May. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 490-4(1955) Oct. (In Russian)

Investigations have been made on the magnitudes of temperature discontinuities arising in the surface layer of He II in a contact with a solid wall that is supplied with heat. (auth)

10238

DIRECT MEASUREMENT OF THE TOTAL LIGHT OF RAPIDLY DECAYING PROCESSES OF LUMINESCENCE. N. A. Tolstoi and I. A. Litvinenko. Soviet Phys. JETP 2, 420-7(1956) May. (In English). Zhur. Eksptl.' Teoret. Fiz. 29, 507-15(1955) Oct. (In Russian)

A new, objective method is proposed for the direct measurement of L_p and L_z for rapidly proceeding luminescent processes. The relationship of the area above the curve of fluorescent rise (L_p) to the area under the curve of fluorescent decay (L_z) can serve as the criterion for the selection of one or another theory of phosphorescence, since the various theories, generally speaking, predict different magnitudes for L_p/L_z. The measurement of L_p/L_z for a quenched ZnS–Cu phosphor indicates the inapplicability of a theory based on a bimolecular mechanism of luminescence and a monomolecular mechanism of decay. (auth)

10239

INVESTIGATION OF THE ORIGIN OF LEVELS OF ELECTRON LOCALIZATION IN ZINC SULPHIDE PHOSPHORS. N. V. Zhukova (Moscow State Univ.). Soviet Phys. JETP 2, 608-19(1956) July. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 680-92(1955) Nov. (In Russian)

The role of copper and oxygen in the formation of three

bands of localization levels of electrons in ZnS–Cu phosphor is clarified by the method of temperature controlled luminescence. The action of iron, nickel and cobalt on the separate maxima of the temperature controlled luminescence curve is examined. It is found that Fe and Ni in small concentrations may sharply increase the intensity of luminescence. (auth)

10240

ON THE LOWERING OF THE LUMINESCENCE YIELD OF PHOSPHORS IN INTENSE EXCITATION. V. V. Antonov-Romanovski and L. A. Vinokurov (P. N. Lebedev Physical Inst., Academy of Sciences, U.S.S.R.). Soviet Phys. 2, 711-13(1956) July. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 830-3(1955) Dec. (In Russian)

It is shown that the lowering of the luminescent output of ZnS–Cu and ZnS–Cu, Co phosphors with intense excitation is conditioned to a considerable degree by the illuminating action of the exciting light and by the fact that the recombination of optical electrons or "holes" results in radiationless transitions. The same causes result in the fact that the total illumination, as determined from the curve of increasing illumination, turns out to be considerably smaller than the total illumination as determined from the curve of the extinction process. (auth)

10241

SOME PROBLEMS IN RECOMBINATION LUMINESCENCE ASSOCIATED WITH VARIOUS FORMS OF EXCITATION IN KCl–Tl PHOSPHORS. I. P. Shchukin (P. N. Lebedev Physical Inst., Academy of Sciences, U.S.S.R.). Soviet Phys. JETP 2, 714-24(1956) July. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 834-46(1955) Dec. (In Russian)

The efficiency of activator-produced radiative electron recombination has been measured in KCl–Tl phosphors using excitation by ultraviolet light, x rays, and γ rays. An estimate is made of the quenching probability at the luminescence center–the Tl^+ ion. The existence of a transfer of excitation energy from the host material to the activator is confirmed. The predominating process is found to be the transfer of phosphorescence excitation energy associated with Tl^+ ionization. A decrease in the activator absorption is found upon stimulation of the phosphor; this is connected with the Tl^+ ionization. (auth)

AEROSOLS

Refer to abstract 10290.

COSMIC RADIATION

10442

ON THE PENETRATING NON-IONIZING COMPONENT OF COSMIC RAYS. G. Bozoki, E. Fenyves, and L. Jánossy (Central Research Inst. of Physics, Budapest). Nuclear Phys. 1, 501-15(1956) June.

Investigations into the penetrating non-ionizing component of cosmic rays were carried out with an apparatus similar to that used by Jánossy and Rochester and the results of the former experiments were substantially confirmed and extended. The collision mean free path for the non-ionizing rays, which must be assumed to consist mainly of neutrons, was found to be 270 ± 28 g/cm^2 in lead. This value is significantly greater than the mean value found for the primaries of penetrating showers. Problems concerning the reliability of the experimental method used are discussed. (auth)

10243

LOW-ENERGY PRIMARY COSMIC-RAY PARTICLES IN 1954. H. V. Neher (California Inst. of Tech., Pasadena). Phys. Rev. 103, 228-36(1956) July 1.

The experiments were made to support and extend the relationship found by Forbush, namely, that there is an inverse relationship between solar activity and cosmic-ray intensity. During the summer of 1954 the sun was at a minimum of activity. Ionization chambers set up in the Arctic as well as at intermediate latitudes showed a considerable increase in intensity, during the period, compared with 1951. Atmospheric absorption combined with magnetic rigidity requirements indicate that protons with energies down to at least 150 Mev were coming to the earth in the summer of 1954. It was concluded that there was no cutoff of primary particles, i.e., no "knee," at least for protons down to this energy. Using the increased areas under the ionization-depth curves, combined with geomagnetic calculations, an estimate may be made of the numbers of primary particles coming in near the poles in 1937 (solar maximum), 1951 and 1954 (solar minimum). These values are 0.10, 0.14, and 0.24 cm^{-2} sec^{-1} sterad^{-1}, respectively. The fluctuations in 1954 were also small compared with those measured in 1937, 1938, and 1951. The evidence points to low intensity and large fluctuations of cosmic rays when the sun is active and vice versa. These changes may be understood qualitatively by assuming a modulating mechanism in the form of clouds ejected from the sun and varying with the solar cycle. (auth)

10244

ANGULAR CORRELATION IN NEW UNSTABLE PARTICLE DECAYS. B. V. Sreekantan, G. Sandri, and A. Pevsner (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 103, 240-3(1956) July 1.

Among the cosmic-ray events recorded with a multiplate cloud chamber there are twelve in which two of the new unstable particles (hyperons or heavy mesons) seem to originate in the same nuclear interaction inside the chamber. Seven events show two neutral V particles, four show one neutral and one charged V, and one a neutral V and an S particle. The histogram of the dihedral angle between the production and decay planes of the unstable particles is found to be consistent with a uniform distribution. This result does not necessarily imply small spin for the new unstable particles. (auth)

10245

COSMIC-RAY NEUTRON INTENSITY INCREASE ASSOCIATED WITH SOLAR FLARE OF FEBRUARY 23, 1956. J. A. Lockwood, H. E. Yingst, A. R. Calawa, and G. Sarmaniote (Univ. of New Hampshire, Durham). Phys. Rev. 103, 247-8 (1956) July 1.

An increase of 35-fold in the cosmic-ray intensity was observed with a neutron detector located at Durham, New Hampshire (geomagnetic latitude $\lambda = 54°$ N), during the solar flare which began at 0330 UT, February 23, 1956. For several days prior to the onset of the flare a large decrease in the daily average neutron intensity was recorded. (auth

10246

GALACTIC RADIOEMISSION AND THE ENERGY RELEASED IN NUCLEAR COLLISIONS OF PRIMARY COSMIC-RAY PROTONS. G. R. Burbidge (California Inst. of Tech., Pasadena). Phys. Rev. 103, 264-5(1956) July 1.

The general mechanisms of galactic radioemission are briefly discussed. It is suggested that the radioemission from our galaxy is a natural result of the presence of a cosmic-ray flux in the interstellar gas and magnetic field. (B.J.H.)

10247

EXTRAORDINARY INCREASE OF THE COSMIC RADIATION OF FEBRUARY 23, 1956. Robert B. Brode and Aurel Goodwin, Jr. (Univ. of California, Berkeley). Phys. Rev. 103, 377(1956) July 15.

During the solar flare event of February 23, 1956, the nucleonic intensity increased by an estimated 600% above normal. The ionizing intensities measured with a shielded (20 cm Pb) and an unshielded Geiger counter telescope showed an estimated increase of 38% and 58% above normal at Berkeley. The time of onset occurred in the interval 0345–0400 UT. (auth)

10248

MORNING LUMINOSITY PRODUCED BY PROTONS FROM ANY DIRECTION. Jeannine Morel-Viard. Compt. rend. 243, 292-5(1956) July 16. (In French)

Consideration is given to a monoenergetic proton beam entering the atmosphere making any angle with the line of force of the geomagnetic field. For each value of the entrance angle, the associated luminosity is calculated. The total luminosity curve is thus deduced. (tr-auth)

10249

OBSERVATIONS ON THE MULTIPLY CHARGED PARTICLES OF THE COSMIC RADIATION. C. J. Waddington (Univ. of Bristol, England). Nuovo cimento (10) 3, 930-55(1956) May.

A nuclear emulsion technique has been used to measure the fluxes of the α particles of the primary cosmic radiation at three different geographical positions. Two of these determinations were made on the same geomagnetic latitude, one over America and the other over England. The two flux values found were significantly different, and this difference could be entirely attributed to the absence over England of those α-particles with energies of less than about 0.65 Gev per nucleon. Measurements on the protons and heavy primary particles detected in those two stacks of emulsions also indicated that the cut-off energy over England at the time of the exposure was between 0.60 and 0.70 Gev per nucleon, instead of the 0.33 Gev per nucleon calculated from the known geomagnetic latitude. Similarly, the data from the American stack suggest that when this was exposed the cut-off energy was less than 0.15 Gev per nucleon. An analysis has been made of the various experimental flux values obtained at different points on the earth's surface, and it is concluded that the cut-off energies should be calculated, not from the geomagnetic latitudes, but from latitudes which are from four to six degrees lower over Europe, and three or more degrees higher over America. (auth)

10250

THE INCREASE IN THE TOTAL COSMIC RAY INTENSITY AND IN THE POSITIVE EXCESS DUE TO THE SOLAR FLARE OF 23RD FEBRUARY 1956. I. Filosofo, I. Modena, E. Pohl, and J. Pohyl-Rüling (Istituto di Fisica dell' Universita, Padova). Nuovo cimento (10) 3, 1112-18(1956) May.

Increases in the total flux and in the positive excess of the cosmic radiation have been detected which were clearly associated with the large solar flare of the 23rd Feb. 1956. The differential and integral spectra for the additional μ-mesons produced in the atmosphere have been derived. The nature of the positive excess of these mesons leads to the conclusion that the particles coming from the flare were mainly protons. Their energy is estimated to lie between 4 and 10 Gev. In this band the primary flux increased to about 25 times normal during the flare. (auth)

10251

NOTE ON THE TECHNIQUE OF EXPERIMENTS ON AIR SHOWER TIME VARIATIONS. K. Sitte (Israel Inst. of Tech., Haifa). Nuovo cimento (10) 3, 1145-7(1956) May.

Shower observation is discussed, and the results of shower observations at 10^{14}, 10^{15}, and 10^{16} ev are given. No time variations were detected in 10^{14}-ev showers, while diurnal variations at 19 and 20 hours were found in 10^{15} and 10^{16}-ev showers. (D.E.B.)

10252

THE FLUX OF THE HELIUM COMPONENT OF THE PRIMARY COSMIC RADIATION AT GEOMAGNETIC LATITUDE 41°N. A. De Marco and A. Milone (Istituto di Fisica dell' Universita, Genova) and M. Reinharz (Centro Studi di Geologia Nuclear dell'Universita, Pisa). Nuovo cimento (10) 3, 1150-2(1956) May.

A value $I_\alpha = 39 \pm 8.6$ He/m^2 s ster. for He flux at 41°N latitude was obtained from emulsion measurements. This value is considerably lower than previously reported values. A review of the techniques used revealed no explanation of the discrepancy. (D.E.B.)

10253

INCREASE OF COSMIC RAY INTENSITY ASSOCIATED WITH THE SOLAR FLARE OF FEBRUARY 23, 1956. F. Bachelet and A. M. Conforto (Istituto di Fisica dell'Universita, Rome). Nuovo cimento (10) 3, 1153-5(1956) May.

Changes in cosmic ray intensity during the solar flare of Feb. 23, 1956 are plotted. (D.E.B.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

10254

INVESTIGATION OF THE STRUCTURE OF THE SURFACE OF FILMS OF COPPER OXIDE ON DIFFERENT FACES OF A MONOCRYSTAL OF COPPER, AND THE DETERMINATION OF THE CONTACT POTENTIAL DIFFERENCE BETWEEN THESE SURFACES. N. B. Gorny (Leningrad Electrotechnical Inst. of Communications). Soviet Phys. JETP 2, 687-95(1956) July. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 808-16(1955) Dec. (In Russian)

The structure of the surfaces of films of copper oxide formed on various faces of a monocrystal of copper is investigated using the method of diffraction of slow electrons. It is found that on faces (100) and (111) of a monocrystal of copper there is formed a monocrystalline film of Cu_2O with a (111) plane parallel to the base. On face (110) a monocrystalline film of Cu_2O is also formed but with a less perfect crystalline structure and with a (110) surface plane. Investigation of the contact potential difference by the method of displacement of the volt-ampere characteristic curves demonstrated that films of Cu_2O on faces (100) and (111) of a monocrystal of copper have the same work function (0.2v), and consequently, have the same crystalline orientation. The film of Cu_2O on the (110) face of copper possesses a larger work function (0.3v), and also has stronger adsorptivity of residual gases than films of Cu_2O on faces (100) and (111), which indicates a difference in the properties (orientations) of the film of Cu_2O on face Cu(110) and of films of Cu_2O on faces Cu(100) and (111). (auth)

ELECTRICAL DISCHARGE

10255 UCRL-4146

California. Univ., Livermore. Radiation Lab.

A PROPOSED PARTICLE CONTAINMENT DEVICE. M. L. Good. July 8, 1953. Decl. Aug. 15, 1956. 24p. Contract W-7405-eng-48. $4.80(ph OTS); $2.70(mf OTS).

A device is proposed for confining charged particles to a localized region of space by means of the alternating electric field of a resonant cavity. The motion of single electrons in the field is stable. The limitations to particle density and temperature are discussed, and found to be too severe to allow the device to serve as a reactor, although it might be a useful laboratory tool. (auth)

10256 UCRL-4466(Pt. I)
California. Univ., Livermore. Radiation Lab.
PART I. AN EXACT ANALYSIS OF A LIMITED PLANE PLASMA IN A MAGNETIC FIELD. Lewi Tonks. Dec. 2, 1954. Decl. Aug. 15, 1956. 23p. Contract W-7405-eng-48. $4.80(ph OTS); $2.70(mf OTS).

A plasma immobilized in a magnetic field has been analyzed by investigating the particle trajectories in the particular case that the density of the plasma depends upon one coordinate only, that all of the particles have the same absolute value of mv/e, that the plasma builds up from a pure vacuum condition, and that any electric fields and space charge effects are absent. The basic equations are developed and the problem is solved in the cases of weak plasmas. Certain general relationships are also developed. (auth)

10257 UCRL-4466(Pt. IV)
California. Univ., Livermore. Radiation Lab.
PART IV. TRAJECTORY-WISE ANALYSIS OF IMMOBILIZED PLASMA INCLUDING ELECTRONS—MACHINE CALCULATIONS. Lewi Tonks and Ralph Keirstead. Mar. 25, 1955. Decl. Aug. 15, 1956. 12p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

The trajectory analysis of an immobilized plasma has been generalized to include the presence of electrons having a far smaller radius of gyration and, therefore, fitting readily into the broader scale structure established by the ions. This problem has been adapted to machine calculations and the results for various strengths plasmas have been calculated. (auth)

10258 UCRL-4510
California. Univ., Livermore. Radiation Lab.
SHOCK-TUBE EXPERIMENTS AT UNIVESRITY OF OKLAHOMA AND CORNELL UNIVERSITY. Elsa L. Huber. May 20, 1955. Decl. Aug. 15, 1956. 16p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

Experiments on expanding low-pressure sparks and shocks produced by adiabatic expansion in compressed gases are reported. (D.E.B.)

10259 UCRL-4549
California. Univ., Livermore. Radiation Lab.
NOTE ON POSSIBLE STABILIZATION DUE TO COUPLING. Howard D. Greyber. July 1, 1955. Decl. Aug. 15, 1956. 9p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

By a simple illustration it is pointed out that, conceivably, the real coupled character of the general magnetohydrodynamic equations may lead to much slower instability growth rates, if not stabilization, than predicted from the linearized set of equations. (auth)

10260 WADC-TR-55-35
Ohmart Corp., Cincinnati.
STUDY AND DEVELOPMENT OF NUCLEAR BATTERIES. Philip E. Ohmart. Dec. 1954. 122p. Project title: IMPROVED ELECTRONIC COMPONENTS. Contract AF33(616)-172. (AD-84555).

The properties of a number of electrode materials were investigated with the aim of increasing the open circuit voltage and efficiency of cells and reducing the temperature coefficient. As a result of this work with electrodes it has been possible to build single cells with open circuit voltage as high as 3.27 volts. A number of different types of nuclear batteries were built and tested with various electrode pairs. These included Models BE, AE, C, RE, V and W batteries. All of these were considered as experimental with the exception of Model RE which was submitted to rather complete tests. These tests showed that by using 10 millicuries of strontium-90 batteries can be produced with open circuit voltages of 1.0 volts and short circuit currents of 4×10^{-9} amperes without encountering a high rejection rate. Temperature coefficient measurements showed that, in general, the open circuit voltage increases and the short circuit current decreases with a rise in temperature. By operating into load resistors of the proper value it is thought that these two temperature coefficients can be made to compensate for each other. (auth)

10261
THE BOLTZMANN EQUATION AND THE ONE-FLUID HYDROMAGNETIC EQUATIONS IN THE ABSENCE OF PARTICLE COLLISONS. G. F. Chew, M. L. Goldberger, and F. E. Low (Los Alamos Scientific Lab., N. Mex.). Proc. Roy. Soc. (London) A236, 112-18(1956) July 10.

Starting from the Boltzmann equation for a completely ionized dilute gas with no inter-particle collision term but a strong Lorentz force, an attempt is made to obtain one-fluid hydromagnetic equations by expanding in the ion mass to charge ratio. It is shown that the electron degrees of freedom can be replaced by a macroscopic current, but true hydrodynamics still does not result unless some special circumstance suppresses the transport of pressure along magnetic lines of force. If the longitudinal transport of pressure is ignored, a set of self-contained one-fluid hydromagnetic equations can be found even though the pressure is not a scalar. (auth)

10262
PENETRATING PLASMA AND ITS RELATION TO THE PRIMARY FOCUSING BEAM. M. D. Gabovich, and E. T. Kucherenko. Zhur. Tekh. Fiz. 26, 996-1003(1956). May. (In Russian)

Parameters of plasma penetrating into the outlet opening of the proton source and the expansion in the surrounding media are examined. It has been found that the potential gradient of the penetrating plasma can achieve considerable magnitude ~50 v/cm. Volt-ampere characteristics, observed during the removal of the ion beam from the source may be explained by localized variations occurring in the penetrating plasma. Consequently, the assertions found in the literature, stating that volume charge limits the ion current, are not substantiated. (tr-auth)

10263
TWO ELECTRODE HIGH-FREQUENCY DISCHARGE AT PRESSURES FROM 100 mm Hg TO ATMOSPHERIC. G. S. Solntsev and M. M. Dmitrieva (Moscow State Univ.). Soviet Phys. JETP 2, 533-9(1956) May. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 651-7(1955) Nov. (In Russian)

Two electrode discharges were investigated in air, nitrogen and argon, in pressures from 100 mm Hg up to atmospheric, and for frequencies of 35 to 36 mc. The intensity of the longitudinal electric field in the canal of a discharge was measured. Separate measurements were carried out at 1.5 mc. The experimental results are discussed. (auth)

10264
THERMO-NUCLEAR EXPERIMENTS. I. V. Kurchatov (Academy of Sciences of the U.S.S.R.). Nuclear Eng. 1, 103-6(1956) June.

Experiments in Russia made with a view to producing temperatures at which a thermonuclear reaction could be expected to take place are discussed. (F.S.)

ELECTRONS

10265 AEC-tr-2555
THE EFFECT OF STRONG ELECTRIC FIELDS ON SECONDARY ELECTRON EMISSION FROM THIN DIELECTRIC

FILMS. D. V. Zernov. Translated from Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 8, 352-6(1944). 9p.

10266

RELATIVISTIC RADIATIVE TRANSITIONS. J. S. Levinger and M. L. Rustgi (Louisiana State Univ., Baton Rouge). Phys. Rev. 103, 439-42(1956) July 15.

Calculations were made of the summed oscillator strength for a K electron in the Coulomb field of a lead nucleus, using calculations of the oscillator strength for discrete transitions, and the oscillator density for absorption to the continuum. 86% of the value unity given by the nonrelativistic Thomas-Reiche-Kuhn sum rule was found. Dispersion theory was used to calculate the forward scattering amplitude as a function of photon energy. Numerical values for the forward scattering amplitude are in good agreement with Brown's values for a K electron of mercury at 1.7, 3.4, and 6.8 times the binding energy. The calculations of the forward scattering amplitude are compared to a nonrelativistic electron in a Coulomb field. (auth)

10267

REDUCTION OF THE DIRAC EQUATION. J. Sucher (Columbia Univ., New York). Phys. Rev. 103, 468(1956) July 15.

A method is given for reducing the Dirac equation for an electron in an external field to small components, leading to reduced equations linear in the time-derivative operator. (auth)

10268

MULTIPLE PHOTON PRODUCTION BY ELECTRON PAIR ANNIHILATION IN FLIGHT. James Joseph (State Univ. of Iowa, Iowa City). Phys. Rev. 103, 481-8(1956) July 15.

Starting with the Feynman-Dyson S matrix, calculations were made of the two leading terms in the high-energy expansion of the cross section for multiple photon production by electron pair annihilation in flight. In the extreme relativistic limit, when $\ln (E_+/m) \gg 1$, where E_+ is the positron energy in the laboratory system, the result reduces to that previously obtained by Gupta. The first four terms in the high-energy expansion of the three-photon production cross section were also calculated. Gupta obtained the leading term only and found a discrepancy between σ_3 and σ_n for $n = 3$ by a factor $\frac{3}{2}$. This discrepancy is removed. For the sake of simplicity, Gupta assumed that the principal contributions to the cross section come from (1) low-energy photons and (2) small scattering angles. That all these assumptions are indeed valid was proved. The possibility of observing multiple photon production is discussed. (auth)

10269

ANNIHILATION OF POSITRONS IN SUPERCONDUCTING LEAD. S. M. Shafroth and J. A. Marcus (Northwestern Univ., Evanston, Ill.). Phys. Rev. 103, 585-8(1956) Aug. 1.

A search was made for changes in the two-quantum annihilation rate when positrons are annihilated in superconducting lead compared to normal lead. The change of state was brought about either by turning off or on a magnetic field or by varying the temperature of the sample. The ratio of the two-photon coincidence rate in normal lead to that in superconducting lead was found to be 1.0011 ± 0.0016 in the magnetic field experiment and 1.0003 ± 0.0011 in the temperature-varying experiment. (auth)

10270

SOME IONIZATION POTENTIAL VARIATIONS AND RELATIONSHIPS. L. H. Ahrens (Oxford Univ., England). J. Inorg. and Nuclear Chem. 2, 290-314(1956) July.

Ionization potential variations and relationships are considered in three parts. The first is devoted to an examination of variation of successive ionization potentials involving valence electrons in several elements. With the exception of some Group II elements in particular, the relationship $I_n = KZ$ is quite closely approximated in several elements and holds both for s and p electrons, but distinctly not for d electrons (I_n = nth ionization potential; that is, the first ionization potential when Z, the ionic charge = 1, the second when Z = 2, etc.; K is a constant). I_n is elevated when passing from p to s electrons in nontransitional elements and when passing from s to d electrons in transitional elements. The magnitude of ΔI (the difference between two successive ionization potentials) can usually be correlated with the existence of closed shells, subshells, and valence states in general, and may serve as a useful semi-quantitative guide in this respect, provided some allowance is made for properties such as weight and size. Variation of I_n in isoelectronic sequences is considered in the second part; the relationship $I_n = aZ^2 + bZ$ is closely obeyed in several sequences. For s electron sequences, constant a varies from R (= 13.59) in the point-charge sequence $H^+ \rightarrow N^{7+}$ to ~0.90 in some 5s sequences; b varies from 2.2 ($Li^+ \rightarrow F^{7+}$) to 10.9 ($He^+ \rightarrow N^{6+}$). a remains uniform at 3.5 in a series of 2p sequences ($B^+ \rightarrow Na^{7+}$ ... $Ne^+ \rightarrow Si^{5+}$), whereas b increases from 5.4 to 16.6. The relationship of a third variable, ionic radius (r), to I and Z is considered in the third part. r varies smoothly with both I and Z in isoelectronic sequences. Various other regularities may be observed; some involve entry of 3d and 4f electrons. For the sequence $Na^+ \rightarrow Cl^{7+}$ and for $Na^+-K^+-Rb^+-Cs^+$, and $Mg^{2+}-Ca^{2+}-Sr^{2+}-Ba^{2+}$, the relationship $I_n\sqrt{r} = 5Z^{1.2}$ holds fairly well. The quantity $5Z^{1.2}/I_n\sqrt{r}$, which equals unity ± a couple of per cent for the above cations, has been suggested as a comparative measure of the shielding (screening) efficiency of cations. (auth)

10271

CONTRIBUTION TO CONVERSION ELECTRON CORRELATION. G. Gimmi, E. Heer, and P. Scherrer. Helv. Phys. Acta 29, 147-86(1956) May. (In German)

The conversion-electron correlation technique was investigated by measuring the γ-γ-, γ-$e_{\bar{K}}$-, $e_{\bar{K}}$-γ-, and $e_{\bar{K}}$-$e_{\bar{K}}$-correlations of Cd^{111}. The results were found to be in good agreement with the theory of Biedenharn and Rose. A study of the $e_{\bar{K}}$-γ-correlation in Hg^{197} led to an unambiguous choice between two possible decay schemes and indicated the spin of the ground state of Hg^{197} to be $\frac{1}{2}$. Conversion-electron correlation experiments also provided an aid in determining the decay scheme of $Hf^{181}-Ta^{181}$. In both these cases, the e^--γ-correlation was found to be disturbed by a perturbation which was attributed to the interaction of the magnetic moment with the field of the excited electron shell. To correct the correlation function for the influence of the size of the source, new correction formulas have been calculated. (auth)

10272

RESEARCH ON LOW ENERGY ELECTRONS EMITTED BY RADIOACTIVE SUBSTANCES. J. B. Bellicard and A. Moussa (Institut de Physique Atomique, Lyon). J. phys. radium 17, 532-3(1956) July. (In French)

A description is given of the improvements effected in the iron free double-focusing spectrometer in order to study low-energy electrons. These include improvements in the vacuum system and compensation of the earth field. The results obtained with this apparatus include K-Auger (Zn^{65}, Co^{57}) and L-Auger (Th B + C) spectra. Conversion electrons of Co^{57} were studied. (auth)

10273

EXPERIMENTAL STUDY OF INTERNAL CONVERSION PAIRS. S. Gorodetzky, R. Armbruster, and P. Chevallier (Institut de Recherches Nucléaires, Strasbourg). J. phys. radium 17, 548(1956) July. (In French)

A beta-ray spectrometer for the angular correlation study of internal conversion pairs has been designed. It has been used to determine the multipolarity of gamma rays in the reactions $C^{12}(d,p)\ C^{13}$, $Be^{9}(\alpha,n)\ C^{12}$, and $B^{11}(p,\gamma)\ C^{12}$. (auth)

Refer also to abstract 10620.

GASES

10274 K-1302(Pt. I)
Oak Ridge Gaseous Diffusion Plant, Tenn.
THE PROBLEM OF KNUDSEN FLOW. PART I. GENERAL THEORY. W. C. DeMarcus. Sept. 5, 1956. 18p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

A résumé of the relevant portion of kinetic theory is given, particular attention being paid to the velocity distribution function of Maxwell and the integro-differential equation it satisfies, the Boltzmann equation. Boundary conditions to be satisfied by solutions of the Boltzmann equation are derived for the 2 cases of purely specular reflection and purely diffuse reflection. It is then shown how solutions of the Boltzmann equation can be constructed for the case of purely specular reflection and also for the diffusely reflecting case, provided that (in the latter case) the wall collision density (molecular impacts per unit of surface area per unit of time) is known for every surface element inside the medium. For the case of purely diffuse reflection a linear integral equation is derived from which the collision density can be determined. (auth)

10275 NAVORD-4086
Naval Ordnance Lab., White Oak, Md.
THE THERMODYNAMIC PROPERTIES OF CARBON DIOXIDE UP TO 1000°C AND 1400 BARS. II. VARIOUS ENERGIES, ISOCHORIC HEAT CAPACITY AND JOULE-THOMSON COEFFICIENT. Donna Price. Aug. 11, 1955. 31p. (AD-77744).

The programs of computation of thermodynamic functions from P–V–T data for carbon dioxide in the range 100 to 1000°C and 50 to 400 bars has been completed with the work of this report. Tables of internal energy, Helmoltz free energy, Gibbs free energy, kinetic energy, the Joule-Thomson coefficient, heat capacity difference, and isochoric heat capacity are given as functions of temperature and pressure. Detailed comparison is made of these data with those of others in the low temperature region. Error estimation is based on an assumed accuracy of 0.2% in PV, of 2% in its first derivatives (with respect to either T or P), and of 20% in its second derivative with respect to T. The region of greatest accuracy is believed to be that of simultaneously high temperature and low pressure (400 to 1000°C and 50 to 400 bars). (NOL abstract).

10276 AEC-tr-2629
MELTING-POINT DIAGRAMS OF SEVERAL BINARY SYSTEMS OF CONDENSED GASES. H. Veith and E. Schröder. Translated by K. S. Bevis from Z. physik. Chem. 179A, 16-22(1937). 8p.

Melting-point diagrams were made of the systems: Kr–CH_4, A–CH_4, A–Kr and A–O_2. The first three systems form nonporous mixed crystals; a minimum exists in the A–CH_4 system and segregation in the solid state at high concentrations of A. In the A–O_2 system, a miscibility gap occurs between 79 and 90 mol per cent O_2. The mixture containing 90 mol per cent O_2 is a peritectic which melts at 55.8° abs. (auth)

10277 AEC-tr-2636
4.2 ANALYSIS OF INERT GASES. H. Kahle. Translated by K. S. Bevis from FIAT Rev. Ger. Sci., 301-5(1939-46). 4p.

Methods for the determination of N_2 and A are given along with methods for the separation, detection, and measurement of density of mixtures of rare gases. (T.R.H.)

10278 AEC-tr-2637
DETERMINATION OF THE GAS PERMEABILITY OF SYNTHETIC FOILS ACCORDING TO THE PRINCIPLE OF CHANGE IN PRESSURE AND VOLUME MEASUREMENTS. PART I. ACCURACY OF MEASUREMENT AND SENSITIVITY. Werner Schrufer. Translated by D. E. Cardamone from Kunststoffe 46, 143-7(1956). 12p.

Accuracy, sensitivity, and errors in the measurement of gas permeability of foils are described. (T.R.H.)

10279
CONCERNING THE CROSS SECTION OF OVERCHARGING OF SLOW IONS IN THEIR OWN GAS. Ia. M. Kagan and V. I. Perel (Karelo-Finnish State Univ.). Soviet Phys. JETP 2, 761-2(1956) July. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 884-6(1955) Dec. (In Russian)

Calculations were made of the cross section of overcharging of slow ions in their own gas, and the results are tabulated. (B.J.H.)

10280
MOLECULAR FLOW OF GASES. G. N. Patterson. New York, John Wiley & Sons, Inc., 1956. 217p. London, Chapman & Hall, Ltd.

Mathematical expressions were developed for gas-flow analysis based on the molecular theory of gases. The problem of flow in a rarefied atmosphere is also discussed. (C.W.H.)

10281
ELECTROMAGNETIC WAVES IN AN IONIZED GAS. Philip Rosen (Univ. of Connecticut, Storrs). Phys. Rev. 103, 390-4(1956) July 15.

A study is made of the effect of space-dependent electric fields upon the complex conductivity of a low-pressure ionized gas. The case of a standing wave is considered first and it is found that the diffusion constant for the electrons becomes space dependent. Finally the case of a traveling wave in an infinite ionized medium is studied. For the latter situation, the spatial variation of the field has no effect on the conductivity. (auth)

10282
MEAN IONIZATION ENERGY IN GASES. IONIZATION DEFECT. Robert Genin (Ecole Pratique des Hautes Études, Paris). J. phys. radium 17, 571-2(1956) July. (In French)

The average energy required to produce an ion pair is determined, for Pu α particles, in air, N_2, A and Ne. The ionization defect, analogous to the quantity defined by Knipp and Ling in their calculation on the ionization produced by heavy charged particles, is given for α particles in air. (auth)

10283
ON DETONATION OF GASEOUS MIXTURE IN CONE-SHAPED TUBES. S. M. Kogarko. (Inst. of Chem. Physics). Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk, 419-26(1956) Apr. (In Russian)

Experiments were made with detonation of explosive gaseous mixtures in cone-shaped tubes. Theoretical conditions are described under which a stable detonation is possible in tubes of constant cross section and infinite volume tubes. (R.V.J.)

INSTRUMENTS

10284 AD-87948
Harvard Univ., Cambridge, Mass. Engineering Lab.
SURVEY OF HOT-WIRE THEORY AND TECHNIQUES.

Richard E. Kronauer. Dec. 1953. 110p. Pratt and Whitney Research Report No. 137.

A survey on the hot-wire anemometer is presented. The theoretical and experimental work of many investigators is summarized and reevaluated, and the present status is discussed. (W.L.H.)

10285 AECU-3265

Los Alamos Scientific Lab., N. Mex.

A TECHNIQUE FOR OBTAINING SUBMICROSECOND EXPOSURE TIMES AT LARGE APERTURE IN HIGH-SPEED PHOTOGRAPHY (thesis). Joseph A. Hull. 1956. 67p. Contract [W-7405-Eng-36]. $10.80(ph OTS); $3.90(mf OTS).

Submitted to University of New Mexico, Albuquerque.

Submicrosecond exposure times in high-speed photographic techniques were accomplished by controlling the illumination of a subject and by controlling the duration of exposure of the film. The duration of exposure may be controlled by mechanical-optical or electrical shutter techniques. A survey of these techniques indicates that the electro-optical Kerr cell shutter is capable of producing single exposure times on the order of 10^{-8} sec if a suitable pulse generator capable of driving a reactive load of several micromicrofarads capacitance is available. The development of an inexpensive pulse generator employing RG 8/U cable is described. This generator is capable of delivering 50,000 volt pulses into a Kerr cell whose capacitance is about 50 uuf yielding a light pulse with rise and decay times of the order of 10^{-8} sec and with effective duration of 0.05 μsec. The pulse generator can be triggered with jitter of about $\pm 10^{-7}$ sec. Some sample photographs of high explosive detonation phenomena are shown. Suggestions for modifying the pulse generator to drive two Kerr cells simultaneously to obtain stereographic images or in optical series to obtain shorter exposure times and greater opacity in the "off" condition are made. (auth)

10286 CREL-651

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

A.E.C.L. PREFERRED ELECTRONIC PARTS LIST. June–July 1956. 71p.

All parts listed have been chosen because of past reliable performance within AECL or elsewhere. (W.L.H.)

10287 HE-150-101

California. Univ., Berkeley. Inst. of Engineering Research.

FLUID FLOW AND HEAT TRANSFER AT LOW PRESSURES AND TEMPERATURES. DESIGN AND OPERATION OF A ROTATING CYLINDER APPARATUS FOR RAREFIED GAS DYNAMICS RESEARCH. G. J. Maslach and J. Frisch. Apr. 30, 1953. 22p. Project NR-061-003. Contract N7-onr-295. (AD-13194).

A rotating cylinder apparatus has been designed and constructed for studies involving gas-surface interaction phenomenon. The instrument also can be used to provide a shear flow field for the development of instrumentation to be used in a non-uniform stream or in a boundary layer. Initial tests indicate the apparatus performs in a satisfactory fashion permitting tests to be made over a wide range of flow conditions from the continuum region, M/RE < 1/100, to free molecular flow region M/Re < 10. (auth)

10288 LA-1508

Los Alamos Scientific Lab., N. Mex.

A HIGH-VACUUM CASTING FURNACE FOR PLUTONIUM. J. W. Anderson and R. L. Thomas. Feb. 17, 1953. Decl. Aug. 16, 1956. 25p. Contract W-7405-Eng-36. $4.25(ph OTS); $2.70(mf OTS).

A high-vacuum casting furnace with an internal diameter of 15 inches has been designed, fabricated, and installed at LASL (DP West). The furnace was designed to accommodate casting crucibles up to 7 inches OD; however with a larger diameter heating element, casting crucibles up to 9 inches could be accommodated. The basic features of the furnace are described and engineering drawings are presented of both the furnace and furnace box. (auth)

10289 NARF-56-71

Convair, Fort Worth, Tex.

MINIATURIZED WIDE BAND LINEAR PREAMPLIFIER FOR AIRBORNE USE. (Convair Model PA-1-2). A. H. Gardner. Aug. 10, 1956. 16p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-119)

A general-purpose, miniaturized, wide-band, linear preamplifier has been designed and built for use in the nuclear test airplane. This preamplifier (Convair Model PA-1-2) is similar electrically to the ORNL Model A-1 preamplifier. Laboratory tests of the 30 production preamplifiers already built show that they are linear within ±10% for input signal between 0 and 60 millivolts and have a 1 megacycle band-pass. The preamplifiers operate satisfactorily at ambient temperatures of 75° ± 15°F, at altitudes up to 40,000 ft, and at vibratory accelerations up to 14 g with the preamplifier assembly shockmounted. Consideration is being given to improvements which will increase the range of temperature, altitude, and vibration. The circuitry and mechanical structure of the preamplifier and the tests performed on it are described. (auth)

10290 NP-6082

California. Univ., Berkeley.

PARTICLE SIZE DISTRIBUTION MEASUREMENTS WITH ELECTRONIC INSTRUMENTATION BASED UPON LIGHT SCATTERING. Chester T. O'Konski, M. D. Bitron, and W. I. Higuchi. Sept. 1, 1956. 57p. Project NR 051-302. Contract ONR-222-12, Technical Report No. 3.

A study was made of the applicability of light scattering to the determination of concentrations and size distributions in systems of spherical particles by combination of photometric and pulse analyzing instrumentation. The results indicate that rapid measurements of a high degree of accuracy and reproducibility are possible with the use of the described instrumentation and methods. Relative scattering intensities for seven sizes of uniform latex aerosol particles in the range 0.333 to 1.17 μ diameter are reported. A brief résumé of previous work in this field is given, and the principal experimental considerations involved in the determination of size distribution spectra are discussed. Possible adaptations of the instrument are indicated. (auth)

10291 SC-3659A(TR)

New Mexico. Univ., Albuquerque.

FACTORS INFLUENCING DIAL OPERATION: THREE-DIGIT MULTIPLE-TURN DIALS. Roger J. Weldon and G. M. Peterson. Feb. 28, 1955. 81p. For Sandia Corp. under P. O. 51-0315. Contract [AT-(29-1)-789]. $0.45 (OTS).

Tests devised and conducted by the Psychology Department of the University of New Mexico to obtain data on the frequency of occurrence of errors in reading and setting multiple-turn dials of five different designs are described. Analysis of the data obtained from the tests lead to the conclusion that dial design has marked effect on speed and accuracy with which the dials may be set and read. The design of Dial 5 is recommended for use under the specifications for this study. The set-check system used in the experiments is found to have an error probability of 0.0015 for this dial. A double-set system, in which two

persons set two automatically interlocked dials, is suggested and it is predicted that this system would reduce the probability of error for Dial 5 to the order of 0.00003. (auth)

10292

ENCYCLOPEDIA OF INSTRUMENTATION FOR INDUSTRIAL HYGIENE. Charles D. Yaffe, Dohrman H. Byers, and Andrew D. Hosey, Tech. eds. Ann Arbor, Univ. of Michigan, 1956. 1243p.

An encyclopedia of instruments for industrial hygiene was compiled from the instruments exhibited at the Symposium on Instrumentation in Industrial Hygiene held at the University of Michigan, May 24-27, 1954. (F.S.)

10293

ON A 14-MEV NEUTRON GENERATOR FOR THE STUDY OF THE INELASTIC SCATTERING OF NEUTRONS. Claude Magnan (College de France, Paris). J. phys. radium 17, 592-3(1956) July. (In French)

A description is given of a new tube for accelerating tritium ions up to 150 kev. The tube uses the T(d, n)He^4 reaction which produces 14-Mev neutrons. A 1 ma triton current hits an aluminum target loaded with deuterium. A direct measurement of the alpha particles produced in the reaction is obtained from a photomultiplier fitted out with an organic phosphor, thus indicating the absolute intensity of the neutron emission. This design, moreover, makes it possible to get alpha–neutron coincidences, with a view to the measurement of inelastic cross sections. A neutron emission of about 10^{10} neutrons per second is expected from the result of the first trials. (auth)

10294

TIME SELECTORS WITH DELAY LINES. J. Thenard and H. Guillon. J. phys. radium 17, Suppl., 57A-9A(1956) June. (In French)

After having examined the possibilities offered by the use of delay lines in time selectors, the design is given for an apparatus which, by the use of these lines, allows the attainment of channel widths of a fraction of a microsecond. In comparison to classical apparatus, certain advantages are found for this system, without placing any restrictions on the possibilities of its use. (tr-auth)

10295

COLLIMATION OF γ RADIATION BY A CYLINDRICAL CIRCULAR CANAL. C. Kellershohn and P. Pellerin. J. phys. radium 17, Suppl., 81A-4A(1956) June. (In French)

An account is given showing the degree of collimation of a γ ray by a cylindrical canal in an absorber. This is applied to the case of the 364-kev γ ray of I^{131} and a canal with lead walls. (tr-auth)

10296

PRACTICAL REALIZATION OF A MAGNETIC QUADRUPOLE LENS FOR VERY HIGH-ENERGY PARTICLES. Albert Septier. Compt. rend. 243, 132-5(1956) July 9. (In French)

A quadrupole magnetic lens, to be used to focus 50-Mev protons, was constructed. It has a focal length which can be varied from 0.8 to 3 m. The design of the lens is discussed in some detail. Measurements of the magnetic fields and gradients are summarized. (B.J.H.)

10297

A NUCLEAR MAGNETIC RESONANCE APPARATUS. A. K. Saha, B. M. Banerjee, T. P. Das, D. K. Roy, S. K. Ghosh Roy, and T. Shose (Institute of Nuclear Physics, Calcutta). Indian J. Phys. 30, 211-41(1956) May.

Following Gutowsky's model, a nuclear magnetic resonance apparatus was set up. It includes both Purcell's double bridge and a marginal oscillator circuit for the detection of nuclear reasonance signals. A detailed account of the instrumentation is presented, and records of the signal obtained by different techniques are also given. (auth)

10298

THE PRODUCTION OF A SHORT DURATION PULSE OF HIGH VELOCITY ELECTRONS. D. H. Le Croissette (Univ. of Southampton). Electronic Eng. 28, 356-8(1956) Aug.

This apparatus produces a pulse of electrons of duration 0·2μsec suitable for initiating ionization in gas-filled systems. The pulse is repeated 50 times per second occurring during the time-base sweep of an oscillograph, so enabling the simultaneous display of the ionizing pulse and the resulting discharge build-up. (auth)

10299

TRANSISTORS IN NUCLEAR INSTRUMENTS. Nuclear Power 1, 79-81(1956) June.

Transistors are finding many applications in modern nuclear instruments. This is because of the advantages they offer of small size, low-power requirements and good reliability. This article outlines the development of high-voltage power supplies for Geiger counters, of radiation monitors and scalers using these new components. It refers to a number of recent papers on the subject, and, in particular, to some presented at a recent meeting at the Institution of Electrical Engineers in London. (auth)

10300

A SENSITIVE AND STABLE NUCLEAR INDUCTION HEAD. E. A. Richards, G. Phillips, and W. K. Campe (Signals Research and Development Establishment, Christchurch, Hants, England). J. Sci. Instr. 33, 260-2 (1956) July.

Details are given of the construction and performance of a "crossed coil" induction head, for the detection of nuclear magnetic resonance in 0.1 cm^3 specimens, in which the condition of maximum sensitivity is achieved through the operation of a single manual control. The simple method of construction provides, at the optimum setting, a decoupling of 80 dB between the coils which remains constant to within 0.4 dB over a period of a week. (auth)

10301

TESTS AND PERFORMANCE OF LUMINESCENT γ SPECTROMETER. A. A. Konstantinov, O. I. Sumbaev, and V. V. Chekin (Mendeleev All Union Research Inst. of Metrology). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 347(1956) Mar. (In Russian)

10302

MEASURING INSTRUMENT FOR MAGNETIC FIELDS UTILIZING THE MAGNETIC RESONANCE OF PROTONS IN β SPECTROSCOPY. A. G. Sergeev, G. D. Latyshev, and V. D. Leonov. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 369-70(1956) Mar. (In Russian).

An instrument using the magnetic resonance of protons was designed which has been used successfully in measuring the magnetic fields in β spectrometers of ρ = 8 cm. The uniform field of the spectrometer created favorable conditions for the use of the instrument. Measurements were made of magnetic fields in the range of 100 to 1300 Oe which on the designed instrument corresponded to the energy range of 60 to 2700 kev. A block diagram of the installation is given. (R.V.J.)

10303

AN ELECTRON INTERFERENCE APPARATUS FOR FINE STRUCTURE INVESTIGATION. Horst Ehlers (Universität Hamburg, Germany). Z. Naturforsch. 11a, 359-67(1956) May. (In German)

Refer also to abstracts 10160 and 10641.

ISOTOPES

10304 UCRL-3322
California. Univ., Berkeley. Radiation Lab.
LIGHT ISOTOPES OF BERKELIUM AND CALIFORNIUM (thesis). Alfred Chetham-Strode, Jr. June 26, 1956. 94p. Contract W-7405-eng-48. $15.30(ph OTS); $5.40 (mf OTS).

An experimental study has been made of the light isotopes of Bk and Cf. The new isotopes Bk^{244}, Bk^{247}, Bk^{248}, and Cf^{244} were identified and their properties studied. Radiations from the Bk isotopes of mass numbers 244 through 249 and of the Cf isotopes of mass numbers 244 through 247 were investigated by nuclear spectroscopic and coincidence techniques. Decay schemes are suggested for several of these isotopes, and observed regularities in the decay patterns of analogous nuclides are discussed. Further information is presented on the production of Am and Cm target materials and the yields of Bk and Cf isotopes from the helium-ion bombardment of Am and Cm. (auth)

10305
AN INVESTIGATION OF THE ISOTOPIC CONSTITUTION OF BORON. V. Shiuttse. Soviet Phys. JETP 2, 402-5 (1956) May. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 486-9(1955) Oct. (In Russian)

When conducting a mass-spectrometer measurement of the isotopic constitution of boron (the compounds of boron were ionized with an electron beam), an effect was observed which depended upon the isotopic distribution. The resulting investigation of this effect showed that during the evaporation of the boron compounds from the platinum oven, vapors of the heavy isotope appeared preferentially, which is an effect opposite to that which should be observed during an ideal evaporation. It was found that in the preparation of gaseous and solid boron compounds a similar separation of the isotopes occurs with the same sign for the separation coefficient. The influence of the indicated distribution effect on the accuracy of the determination of the isotopic constitution of boron was investigated. (auth)

Refer also to abstracts 10470 and 10648.

ISOTOPE SEPARATION

10306
OXYGEN ISOTOPE EFFECTS AT ANODES. Michael Anbar and Henry Taube (Univ. of Chicago). J. Am. Chem. Soc. 78, 3252-5(1956) July 20.

The isotope fractionation factor for O_2 liberated from water at an anode shows considerable variation with the nature of the electrode material, but is independent, at least over a limited range, of the current density. Mechanisms of the reaction are discussed. Tracer experiments using PbO_2 and MnO_2 as electrode material showed that none of the anode oxygen appears as O_2. They showed also that rapid exchange of the oxide electrode with water is induced when the material functions as an anode. (auth)

MASS SPECTROGRAPHY

Refer to abstract 10056.

MATHEMATICS

10307 ORNL-2120
Oak Ridge National Lab., Tenn.
A NEW ESTIMATION PROCEDURE FOR LINEAR COMBINATIONS OF EXPONENTIALS. Richard Garth Cornell. June 21, 1956. 163p. Contract W-7405-eng-26. $0.75 (OTS).

A new estimation procedure was developed for a model specifying a linear combination of exponentials of the form

$f(t) = \sum_{k=1}^{p} \alpha_k \exp[-\lambda_k t]$ with data taken at evenly spaced points, and for that model with a constant term added. The distributions and statistical properties of the resultant estimators were also studied. Confidence intervals were developed and several examples plus a sampling survey were presented. (C.W.H.)

10308 ORNL-2146
Oak Ridge National Lab., Tenn.
I. ITERATIVE METHODS FOR THE APPROXIMATE SOLUTION OF LINEAR ALGEBRAIC SYSTEMS. II. SELF-ADJOINTNESS IN ONE-GROUP MULTI-REGION DIFFUSION PROBLEMS. Theodore W. Hildebrandt. Sept. 10, 1956. 64p. Contract W-7405-eng-26. $0.40 (OTS).

Iterative techniques for the approximate solution of non-singular linear algebraic systems are developed. In particular, a new modification of the so-called Seidel method analogous to the classical method of steepest descent is given. In the course of the investigation, a vector process analogous to the well-known scalar δ^2-process was defined. It was found that repeated application of this vector δ^2-process to the classical Jacobi iteration for linear systems produces an iteration identical to the classical method of steepest descent. On the other hand, it is shown that the vector δ^2-process does not have the property of the scalar δ^2-process of increasing the order of an iteration. A condition which, when satisfied at the interfaces, is sufficient to insure the self-adjointness of a class of multi-region one-group problems is also presented. (auth)

10309 RM-1743(RAND)
RAND Corp., Santa Monica, Calif.
A TABLE OF THE PLANCK RADIATION FUNCTION AND ITS INTEGRAL. F. R. Gilmore. July 2, 1956. 22p.

Values of the dimensionless Planck function, $x^3/(e^x-1)$, and its normalized integral, $(15/\pi^4)\int_0^x x^3/(e^x-1)\,dx$, are given to five significant figures, for x = 0 (0.02) 10. It also gives five-figure values for the Planck function and its complementary integral (between x and ∞) for x = 10 (0.1) 20. Errors are believed to be less than 1 in the fifth figure. (auth)

10310
GENERAL FORMULAS FOR LEAST SQUARES REDUCTION OF ZEEMAN DATA. K. L. Vander Sluis (Oak Ridge National Lab., Tenn.). J. Opt. Soc. Amer. 46, 605-8(1956) Aug.

A least squares analysis is applied to the reduction of complete and incomplete Zeeman patterns. The resulting general formulas provide a simple systematic computation of the "best values" of the Landé g factors and a measure of their precision. (auth)

10311
A NUMERICAL METHOD FOR SOLVING THE TWO-DIMENSIONAL NEUTRON DIFFUSION EQUATION. R. M. Pearce (Atomic Energy of Canada Ltd., Chalk River, Ont.). J. Nuclear Energy 2, 277-85(1956) June.

Conventional numerical methods for solving differential equations on a two-dimensional mesh are adapted to solving the one-group pile equation. The method yields the neutron density and the radial Laplacian in a standard manner which is not dependent on the number of control rods or other lattic irregularities. The procedures for calculation

with a desk machine and with a large digital computer differ in certain respects, and are discussed. As an example, the distribution of neutron density is given for a reactor with seven asymmetrically inserted control rods. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

10312 AERE-RE/R-1492

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A SOLID PARTICLE ACTIVITY DETECTOR. A. E. Herriott. Aug. 4, 1954. 28p.

An instrument is described in which a series of effluent gas samples are taken and each sample filtered to remove the solid particulate matter and the β activity of these filtered solids is measured and recorded. The equipment was designed and built to give an indication of the Harwell reactor main extract duct filter efficiencies. Experience has shown that it is generally valuable where knowledge is required of the activity of dust in quantities of gas. It has also shown a very good indication of the fission product release and uranium oxide contamination of the reactor charge. (auth)

10313 CF-55-12-121

Oak Ridge National Lab., Tenn.

PARTICLE ACTIVITY DETERMINATION BY AUTORADIOGRAPHY. H. H. Abee. [Dec. 1955]. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

An investigation was made of the relationship between the activity of a radioactive airborne particle and the diameter of the image produced when the particle is autoradiographed. It was concluded that some measure of the activity of a particle can be obtained from the size of the resulting image on the autoradiogram provided the exposure time is known. A practical method for rapid evaluation of large numbers of particles on a routine basis could employ visual comparison to standard particle images. (C.H.)

10314 IGO-AM/W-56

Gt. Brit. Windscale Works, Sellafield, Cumb., England.

THE DETERMINATION OF RADIO-IODINE IN GRASS. O. Jones. July 12, 1956. 7p.

A method is described for the radiometric determination of the radioiodine content of grass. (C.H.)

10315 IGO-AM/W-57

Gt. Brit. Windscale Works, Sellafield, Cumb., England.

COUNTING IODINE-131 IN SAMPLES OF CHEMICALLY SEPARATED IODINE. O. Jones and L. P. O'Connor. July 11, 1956. 7p.

Iodine^{131} is determined by counting with thin end-window equipment. Previously determined corrections for external absorption and scatter, self-absorption and scatter and geometry and decay scheme factors are applied to the results. (auth)

10316 LA-1717

Los Alamos Scientific Lab., N. Mex.

A WHOLE BODY GAMMA COUNTER FOR HUMAN SUBJECTS. Ernest C. Anderson, Robert L. Schuch, J. D. Perrings, and Wright H. Langham. Sept. 1955. 53p. [Contract W-7405-eng-36.].

A new 4π liquid scintillation counter for the measurement of the γ activity of human subjects is described, including details of physical construction and operating characteristics. The counter has a background of ~400 c/s and a counting efficiency of about 10% for 1.5 Mev γ rays. The natural potassium content of man can be measured to a precision of 5% in 100 seconds of counting time. The ultimate sensitivity is about 5×10^{-10} curie and the sample capacity about 300 pounds. Results of the measurement of the γ activity of 62 persons are given and possible uses of the instrument are discussed. (auth)

10317

RADIATION DOSIMETRY. Gerald J. Hine and Gordon L. Brownell, eds. New York, Academic Press Inc., 1956. 932p.

Fundamental principles or radiation dosimetry are outlined. Several types of instrumentation are described. The dosimetry of various radiation fields is discussed. (C.W.H.)

10318

HAOLOGEN-QUENCHED GEIGER-MÜLLER COUNTERS. I. D. H. Le Croissette (Univ. of Southampton). Atomics 7, 205-10 & 214(1956) June.

After a survey of the discharge mechanism of a G-M counter there follows a consideration of the factors which are responsible for the operation of the low voltage, halogen-quenched type. In particular, the presence of metastable rare gas atoms is shown to have a great effect upon the low voltage operation, the large output pulse, and the production of oscillations. Advantages and disadvantages of these counters are summarized. (auth)

10319

A HIGH PRESSURE METHANE IONIZATION CHAMBER. F. J. M. Farley (Atomic Energy Research Establishment, Harwell, Berks, England). J. Sci. Instr. 33, 276-8(1956) July.

An ionization chamber, 2 in. in diameter and 8 in. long, using quartz-Invar seals is described. Filled with fractionally distilled methane to a pressure of 40 atm and operated at 12 kv the chamber has an efficiency of 10% for counting 3 Mev neutrons and a collection time of the order of 1 μs. Detailed information on counting efficiencies and delay times is presented. (auth)

10320

AN AUTOMATIC DEVICE FOR FIXING THICK NUCLEAR EMULSION LAYERS. G. Thuro (Ruder Boškovic Inst., Zagreb, Yugoslavia). J. Sci. Instr. 33, 296-8(1956) Aug.

A simple device for fixing thick nuclear emulsion layers has been constructed; it keeps the fixer flowing first one way and then the other through the box in which emulsion layers are kept. The flow of the fixer can be made as slow as required which is specially useful for continuous dilution of the fixer. The fixer runs from one flask, through the box, into another flask, and back, being driven by the pressure of the water mains. The direction of flow is automatically reversed by an electromagnetic switch, when the water in one of the flasks makes contact between a pair of electrodes. (auth,

10321

A HIGH-PRESSURE DIFFUSION CLOUD CHAMBER IN A PULSED MAGNETIC FIELD. A. P. Batson, P. N. Cooper, and L. Riddiford (Univ. of Birmingham, England). J. Sci. Instr. 33, 302-6(1956) Aug.

A description is given of an 18-in. diameter high-pressure diffusion cloud chamber constructed for use with the Birmingham proton synchrotron. The associated equipment to provide a pulsed magnetic field of 13 kG at each synchrotron pulse is discussed and an account of the operation of the apparatus is given. (auth)

10322

A "HODOSCOPED" COSMIC-RAY RECORDER. J. C. Barton (Univ. Coll. of the West Indies, Jamaica). J. Sci. Instr. 33, 308-11(1956) Aug.

A portable Geiger-Muller counter apparatus is described. It includes an eight-channel hodoscope and is designed for use at great depths. Simple transistor circuit techniques

are used in conjunction with magnetic tape recording. A discussion is given of the operation of counters from a stabilized voltage supply for greatest possible battery life. The complete equipment consumes about 50 mW and will operate unattended from one set of batteries for longer than a month. The apparatus has been operated successfully in a coal mine at a depth of 1500 ft below the surface. (auth)

10323

TWO BETTER WAYS TO DETERMINE GEIGER-MUELLER-TUBE AGE. J. S. Reddie and Wm. C. Roesch (General Electric Co., Richland, Wash.). Nucleonics 14, No. 7, 30-2 (1956) July.

Two new coefficients provide a linear measure of counter age. Threshold coefficient, the change in threshold voltage per tenfold increase in counting rate. Amplitude coefficient, absolute value of exponent in the power law expressing the relation between pulse height and counting rate at fixed voltage. (auth)

10324

HIGH-EFFICIENCY SLOW-NEUTRON SCINTILLATION COUNTERS. K. H. Sun, P. R. Malmberg, and F. A. Pecjak (Westinghouse Electric Corp., East Pittsburgh). Nucleonics 14, No. 7, 46-9(1956) July.

The scintillation counter has advantages of ruggedness, better time resolution and superior geometrical definitions than other types. It is also believed to be more efficient for themal-neutron scintillation counting. (W.L.H.)

10325

STABILIZATION FILM PROCESSING FOR X- AND γ-RAY DOSIMETRY. Steven Levinos and Margarete Ehrlich. Nucleonics 14, No. 7, 72-4(1956) July.

Stabilization processing is a promising procedure for fast-field development of photographic dosimeter films where water supplies are scarce. (auth)

10326

CALCULATING AVERAGE COUNTING RATES. D. B. Zilversmit (Univ. of Tennessee, Memphis) and Alan L. Orvis (Mayo Clinic, Rochester, Minn.). Nucleonics 14, No. 7, 75 (1956) July.

10327

PERIODIC CONTROL OF THE FUNCTION AND CONSTANCY OF IONIZATION CHAMBER DOSE METERS. R. Thoraeus. Acta Radiol. 45, 503-11(1956) June.

The need and conditions of periodic control of ionization chamber dose meters are discussed. The arrangement used for such control, particularly a radium gamma ray standard and associated housing devices, are described in detail. The accuracy of the control obtained by these devices is illustrated by some measuring results. (auth)

10328

GRAIN DENSITY OF PROTON TRACKS IN DILUTE NUCLEAR EMULSIONS. Georges Philbert. Compt. rend. 243, 36-8(1956) July 2. (In French)

The grain density as a function of energy loss in halogenure is represented satisfactorily by an equation of the form $dN/dR = C\{1-\exp[-b(dE/dR)^{\frac{1}{2}}-a^{\frac{1}{2}}]\}$ proposed by Morand and van Rossum. (tr-auth)

10329

MEASURING BODY RADIOACTIVITY. Nuclear Power 1, 62-4(1956) June.

Various instruments uniquely developed for this purpose are described. (F.S.)

10330

STATISTICS OF RADIATION MEASUREMENTS. E. N. Shaw. Nuclear Eng. 1, 152-5(1956) July.

Before designing equipment or experiments based on radiation techniques it is necessary to know the limitations imposed by the statistical fluctuations of the detected radiation. The value of counting results is always determined by statistical significance of the figures. (auth)

10331

THE LITERATURE OF INSTRUMENTATION FOR RADIOLOGICAL STUDIES. Marjorie Comstock (Brookhaven National Lab., Upton N. Y.). I.R.E. Trans. Nuclear Sci. NS-3, 15-17(1956) June.

Instrumentation for radiological studies is interpreted as relating to device or tools for measurement purposes or for implementing research studies in which radioactive material is used. In radiological studies, instrumentation plays a vital part due to the hazards involved in handling radioactive material, and due to the necessity for accurate measurements. The varied fields of research include use of the nuclear reactor, hot laboratory installations, accelerators, cloud chambers, and many other pieces of apparatus. All of these require accessory instruments in order to use them successfully. The list of instruments is lengthy and is mentioned merely to illustrate the spread of the subjects covering the literature of instrumentation for radiological studies. Therefore, it is necessary to have the subject as clearly defined as possible before attempting to search the literature. A good introduction to the literature of instrumentation is Guide to Instrumentation Literature. This contains an extensive bibliography. The various abstract journals, books, report literature, and other approaches to the literature are discussed. (auth)

10332

DIAMOND, A PRACTICAL RADIATION COUNTER. W. F. Cotty. J. Brit. Inst. Radio Engrs. 16, 329-43(1956) June.

The properties which make diamond an attractive material for a practical conduction counter are discussed and the general theory of conduction counting is outlined. The counting property is thought to be a structural property and this also is responsible for the ill effects of polarization; diamonds, however, have been found which have the natural ability to maintain a steady counting rate for long periods and a method for selecting them is given. It is suggested that, for practical purposes, the diamond should be drilled with a small hole for the inner electrode and mounted at the end of a rigid or flexible cable; finally, the principles of amplification are described in detail. (auth)

10333

N-PENTANE AS STABILIZING AGENT IN PROPORTIONAL COUNTERS. H. C. Hamers and Th. J. De Boer (Natuurkundig Laboratorium van de Vrije Universiteit, Amsterdam). Physica 22, 443-8(1956) May.

The properties of normal-pentane as polyatomic constituent in proportional counters are investigated. The energy resolution in argon n-pentane and krypton n-pentane is found to be a satisfactory polyatomic constituent for proportional counters. (auth)

10334

USE OF PHOTONEUTRON METHOD IN STUDIES OF HARD γ RAYS OF LOW INTENSITIES. B. S. Dzhelepov and I. A. Yaritsyna (Mendeleev All Union Inst. of Metrology). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 343-6(1956) Mar. (In Russian)

Uranium spiral chambers and activated Mn were used in detection studies of hard γ rays of low intensities in Co^{60}, Sb^{124}, Ag^{110}, and In^{114}. Physical results are tabulated. (R.V.J.)

10335

THE PHOTOGRAPHIC ACTION OF IONIZING PARTICLES. I. THE FORM OF THE BLACKENING CURVE FOR PHOTOGRAPHIC FILM EXPOSED TO RADIATION. A. L. Kartuzhanskii. Soviet Phys. JETP 2, 550-8(1956) May.

(In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 516-28(1955) Oct. (In Russian)

The form of the curve expressing the blackening density of an irradiated photographic film is investigated as a function of the exposure. The data obtained for films of various sensitivity and various types of radiation, as well as the data concerning the effect of supplementary exposure, are used to determine the degree of dispersion of the latent image. (auth)

10336

DETECTION OF NEUTRONS WITH AN INDIUM PHOSPHIDE-p-n-ELEMENT. R. Gremmelmaier and H. Welker. Z. Naturforsch. 11a, 420-2(1956) May. (In German)

10337

RECENT PROGRESS IN THE AREA OF SCINTILLATION COUNTERS. J. Labeyrie (Centre d'Études Nucléaires, Saclay). J. phys. radium 17, 576-80(1956) July. (In French)

The present state of knowledge on photomultipliers, and on solid, liquid or gaseous phosphors for detecting nuclear particles is described. (auth)

10338

STUDY WITH A PHOTOMULTIPLIER OF THE LUMINOUS PULSES PRODUCED IN THE GAS OF A PROPORTIONAL COUNTER. G. Charpak and G.-A. Renard (College de France, Paris). J. phys. radium 17, 585-6(1956) July. (In French)

The light emitted by the atoms excited during a discharge in a proportional counter has been studied with a photomultiplier with a 1-inch diameter photocathode. Preliminary results are reported with mixtures of argon–propane and krypton–propane as filling gases. Checking the counter with 5.9-kev and 9.2-kev x rays shows: that the light is emitted by excited states of half-life close to 2×10^{-7} seconds. That the intensity of light is proportional to the energy of the x rays when the counter is working in the proportional region. For the experimental conditions described, the lower limit for the energy of the x rays detectable by this method is 1 kev. This can be improved in particular by better geometry. (auth)

10339

IONIZATION CHAMBER FOR SHORT PERIOD α EMITTERS. J. Olkowsky, G. Valladas, and L. Cohen (Service du Physique Nucléaire, Saclay). J. phys. radium 17, 587(1956) July. (In French)

A very simple pulse ionization chamber was built for studying short half-life alpha emitters (≥ some minutes). The resolution is good and the background very low. (auth)

10340

ABERRATION OF A CIRCULAR SOURCE IN A β SPECTROMETER WITH A UNIFORM AXIAL FIELD. L. Dick (Institut du Radium, Paris). J. phys. radium 17, 590-1(1956) July. (In French)

From the shape of the line from an eccentric point source in a β spectrometer with an axially uniform field, a calculation was made of the shape of the line from an extended source. (tr-auth)

10341

EFFICIENCY OF END WINDOW G.M. COUNTERS FOR LOW ENERGY ELECTROMAGNETIC RADIATIONS. Maurice Duquesne (College de France, Paris). J. phys. radium 17, Suppl., 85A-9A(1956) June. (In French)

Calculations were made of the efficiency of the useful volume of an end window G-M counter for diverging radiations, by considering the screen, the window, and other counter regions as ineffective. Calculations were made of the effectiveness of the screen and the contribution of the region situated behind the useful volume. Comparisons were made between experimental and calculated values. (tr-auth)

10342

CALCULATION FOR AN IONIZATION CHAMBER WITH THICK GRAPHITE WALLS DESIGNED TO MEASURE THE INTENSITY OF HIGH-ENERGY γ RAYS (UP TO 50 MEV). C. Schuhl. J. phys. radium 17, Suppl., 97A-103A(1956) June. (In French)

Calculations were made of the sensitivity of an ionization chamber with thick graphite walls as a function of γ energy. The calculation was carried out for thicknesses of 4.5, 9, and 13.5 cm of graphite of density = 1.76 g/cm^3 and for γ energies up to 50 Mev. Calculations were also made of the range–energy relations for electrons within this energy range. Results obtained in the measurement of a betatron flux (bremsstrahlung) are compared to other detection methods. They agree within the limits of approximation of the calculation. (tr-auth)

10343

NEW TYPES OF IONIZATION CAMERAS AND THEIR APPLICATIONS TO THE STUDY OF RADIOACTIVE MINERALS. U. Facchini, M. Forte, A. Malvicini, and T. Rossini (Laboratori CISE, Milan). Energia nucleare (Milan) 3, 182-7(1956) June 15. (In Italian)

Descriptions are given of various types of ionization cameras which are particularly adapted to the analysis of α spectra of radioactive minerals properly treated and reduced to thin layers. These can therefore be used to establish the presence of U and Th and the degree of equilibrium of the radioactive nuclides of the minerals. Also the quantitative determination of the concentrations can make known the weight of the emitting material introduced into the ionization camera. (tr-auth)

10344

RESPONSE OF PHOTOGRAPHIC EMULSIONS TO CHARGED PARTICLES AND NEUTRONS. E. Tochilin, B. W. Shumway, and G. D. Kohler (U. S. Naval Radiological Defense Lab., San Francisco). Radiation Research 4, 467-82(1956) June.

By means of 240-Mev protons, 190-Mev deuterons, and 380-Mev α-particles, the dosage sensitivity of three dosimeter films and one nuclear emulsion were investigated. Measurements were made by exposing films sandwiched between a series of absorbers so that readings were obtained as a function of particle range. In this manner dosage sensitivity curves were determined over values of specific ionization extending from minimum to maximum for singly charged particles. Characteristic curves for the dosimeter films were identical in shape for all particle energies. From the observed similarity between the dosimeter films and electronsensitive nuclear emulsions, it was concluded that the average grain sensitivity of these films is such that any singly charged particle passing through a grain will impart sufficient energy to render it developable. For specific ionization values from minimum to six times minimum, characteristic curves for the NTB nuclear emulsion were found to be dependent on particle energy. Above this value the characteristic curves remained constant. Experimental values of neutron film response were obtained for a Po-Be source and for the neutron spectra produced by bombarding a Be target with 12-Mev protons and with 20-Mev deuterons. Calculated values were also obtained on the basis of film response to the resulting recoil protons for each neutron spectrum. The dosimeter films were highly insensitive to neutrons and for this reason were found useful as detectors of γ-rays in the presence of neutrons. (auth)

10345

A COMPARISON OF RADIUM AND COBALT-60 GAMMA-RADIATION FIELDS. H. M. Childers and J. D. Graves

(Naval Research Lab., Washington, D. C.). Radiation Research 4, 493-9(1956) June.

10346

STUDIES OF DOSE DISTRIBUTIONS IN WATER FOR BETATRON X-RAYS UP TO 37 MEV. B. Zendle, H. W. Koch, J. McElhinney, and J. W. Boag (National Bureau of Standards, Washington, D. C.). Radiation Research 5, 107-26(1956) Aug.

Dose-distribution measurements were made in water for finite width x-ray beams of maximum energy of 11, 16.2, 20.3, 23.8, 28.5, 33.6, and 37 Mev. An 8 × 8 × 5-mm anthracene crystal and a 25-r Victoreen thimble chamber were used as detectors, and measurements made to 1-meter depth indicated proportionality of response for the highest energy investigated. Measurements made of the dose from radiation scattered to the central axis in masonite for annular x-ray beams of various mean radii made possible the correction of the dose-distribution data for the 14-cm-diameter beam to what they would have been for a uniform beam of infinite extent. Measurements of the x-ray beam flux with a secondary standard whose response was calculated and calorimetrically calibrated permitted evaluation of a dose conversion factor of 92.4 ergs/gm of water per esu/cm^3 of ionization measured in an air cavity in the water. This was accomplished by a linear integration of the 37-Mev broad-beam ionization dose-distribution function, normalized to the incident x-ray energy per unit area. The value calculated from the Bragg-Gray relation for 37-Mev x-rays is 93.5 ergs/gm per esu/cm^3. The experimental value agrees with this value within the expected experimental uncertainty discussed in the section on errors. The broad-beam dose-distribution data agree with Brysk's detailed calculations of the energy dissipation in water for 14-Mev betatron x-rays. The principal features of the experiment were the determination of the dose curve in water and its agreement with the theoretical calculations of Brysk. The scattered dose correction made this agreement possible. (auth)

10347

THE INTRODUCTION OF THE RAD IN RADIOTHERAPY PRACTICE: A SYMPOSIUM. I. RADIATION UNITS IN USE IN GREAT BRITAIN. Ralston Paterson (Christie Hospital and Holt Radium Inst., Manchester, England). Brit. J. Radiol. 29, 353-5(1956) July.

10348

THE INTRODUCTION OF THE RAD IN RADIOTHERAPY PRACTICE: A SYMPOSIUM. II. THE TRANSITION FROM RÖNTGEN TO RAD. L. H. Gray (Mount Vernon Hospital, Northwood, Middlesex, England). Brit. J. Radiol. 29, 355-8(1956) July.

10349

THE INTRODUCTION OF THE RAD IN RADIOTHERAPY PRACTICE: A SYMPOSIUM. III. THE USE OF THE RAD IN CLINICAL DOSAGE. M. J. Day (Royal Victoria Infirmary, Newcastle upon Tyne, England). Brit. J. Radiol. 29, 358-67(1956) July.

10350

THE INTRODUCTION OF THE RAD IN RADIOTHERAPY PRACTICE: A SYMPOSIUM. IV. CONVERSION OF RÖNTGENS TO RADS. F. Ellis (The Churchill Hospital, Oxford, England). Brit. J. Radiol. 29, 367-9(1956) July.

10351

MEASUREMENT OF ENERGY ABSORPTION BY IONIZATION CHAMBERS. E. W. Emery (Univ. of Manchester, England). Brit. J. Radiol. 29, 370-6(1956) July.

10352

THE RAPID RECONSTRUCTION OF RADIUM IMPLANTS. A NEW TECHNIQUE. L. E. Mussell (Radium Inst., Liverpool, England). Brit. J. Radiol. 29, 402-7(1956) July.

10353

THE USE OF CADMIUM SULPHIDE CRYSTALS IN PROBE AND NEEDLE DOSE MEASURING SYSTEMS. G. F. Mauldon and J. H. Martin (Peter MacCallum Clinic, Melbourne, Australia). Brit. J. Radiol. 29, 427-33(1956) Aug.

Investigations have been carried out on the use of semiconductor cadmium sulfide crystals as a means of measuring radiation intensity. A number of the properties of these crystals under d-c conditions are reported, and are found to be consistent with the model for photoconductivity as suggested by Rose in which the distribution of trapping depths for the conduction electrons is exponential. Suitable crystals have been mounted in probes and hypodermic needles for use in intracavitary and interstitial measurements. A description of these measuring systems and information on the interpretation of readings obtained in terms of dose received under differing conditions of radiation quality are given. (auth)

10354

PHOTOGRAPHIC BADGES FOR THE ESTIMATION OF THE QUALITY OF X AND GAMMA RADIATION. B. W. Soole (Admiralty Research Lab., Teddington, Middlesex, England). Brit. J. Radiol. 29, 450-4(1956) Aug.

10355

IRON AS AN IMPURITY IN COLLOIDAL GRAPHITE: ITS EFFECT ON THIMBLE IONIZATION CHAMBER PERFORMANCE. L. A. W. Kemp and Barry Barber (London Hospital). Brit. J. Radiol. 29, 457-60(1956) Aug.

The effect on thimble ionization chamber performance of iron or other relatively heavy atoms as contaminants in colloidal graphite preparations used for coating the chambers is discussed. (C.H.)

10356

SOLID SCINTILLATORS FOR BETA RAY SPECTROMETRY. A. Bisi, E. Germagnoli, and L. Zappa (Istituto di Fisica Sperimentale del Politecnico, Milan). Nuovo cimento (10) 3, 1007-16(1956) May.

A beta ray spectrometer and a β–γ coincidence spectrometer using anthracene crystals are described. The results of some measurements concerning simple and complex decays are given. In particular the decay of Tm^{170} has been reinvestigated. (auth)

10357

THE TEMPERATURE COEFFICIENT AND THERMAL STABILITY OF SELF QUENCHING GEIGER-MUELLER COUNTERS CONTAINING AN ORGANIC VAPOR. D. Blanc and R. Viste (College de France, Paris). Nuovo cimento (10) 3, 1119-30(1956) May. (In French)

10358

SPECIFIC α RADIOACTIVITY OF ILFORD EMULSIONS FOR NUCLEAR RESEARCH. II. SURFACE ACTIVITY. S. Deutsch (Universite Libre de Bruxelles). Nuovo cimento (10) 3, 1166-8(1956) May. (In French).

10359

A NEW DETECTOR OF IONIZING RADIATION. THE GAS BUBBLE CHAMBER. P. E. Argan and A. Gigli (Istituto di Fisica dell'Universita, Genova). Nuovo cimento (10) 3, 1171-2(1956) May.

The design and operation of a gas bubble chamber using a CO_2-ether system are given. (D.E.B.)

Refer also to abstract 10125.

MESONS

10360

ON THE ANOMALOUS L-X-RAY YIELD IN LIGHT MESIC ATOMS. M. Demeur (Univ. of Copenhagen, Denmark). Nuclear Phys. 1, 516-29(1956) June.

The properties of a cascade with $\Delta n = 1$ and $\Delta l = \pm 1$ are investigated. It is shown that, if the initial distribution is a statistical one (i.e. proportional to $(2l + 1)$), accumulation occurs in the states of intermediate angular momentum. Application is made to the case of π carbon, starting with a statistical distribution on the states $n = 17$. (auth)

10361

ORIENTATION OF PLANES IN DOUBLE V° DECAY EVENTS. V. M. Kharitonov (Physical Inst., Academy of Sciences, Armenian S.S.R.). Soviet Phys. JETP 2, 741-2 (1956) July. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 868-9(1955) Dec. (In Russian)

Some remarks are made concerning data obtained by Bellam et al on double V° events. It is concluded that, on the basis of their statistics, no conclusions can be made concerning a correlation between the directions of the decay planes of the secondary particles and the plane of the V° particles. (B.J.H.)

10362

FORMATION OF NEUTRAL π-MESONS IN (n-p) COLLISIONS AT EFFECTIVE NEUTRON ENERGIES OF 590 MEV. V. P. Dzhelepov, K. O. Oganesian, and V. B. Fliagin (Institute for Nuclear Problems, Academy of Sciences, U.S.S.R.). Soviet Phys. JETP 2, 757-60(1956) July. Zhur. Eksptl.' i Teoret. Fiz. 29, 886-9(1955) Dec. (In Russian)

The sum of the total cross sections for forming π^0 mesons in the reactions $n + p \rightarrow \pi^0 + n + p$ was found by measuring the number of γ quanta from the decay of π^0 mesons coming out of the target at 90°. The γ quanta were detected in the telescope of two scintillators and one Cerenkov counter. On the assumption that the angular distribution of π^0 mesons is isotropic in the center of mass system of the colliding nucleons, the total cross section was found to be $\sigma_{np}^{\pi^0} = (5.9 \pm 1.5) \times 10^{-27}$ cm^2. In the case of an angular distribution $\sim \cos^2\theta$ for π mesons having a momentum equal to half the maximum, the cross section is $\sigma_{np}^{\pi^0} = (6.3 \pm 1.7) \times 10^{-27}$ cm^2. (B.J.H.)

10363

INELASTIC SCATTERING OF MESONS IN THE SEMI-PHENOMENOLOGICAL THEORY OF THE INTERACTION OF π-MESONS WITH NUCLEONS. Iu. M. Popov and A. A. Rukhadze (P. N. Lebedev Physical Inst., Academy of Sciences, U.S.S.R.). Soviet Phys. JETP 2, 767-8(1956) July. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 893 (1955) Dec. (In Russian)

Calculations were made of the scattering cross sections of π^- and π^+ mesons on protons taking into account the contribution of $S_{1/2}$, $P_{1/2}$, and $P_{3/2}$ waves. The results are in favorable agreement with experimental values. (B.J.H.)

10364

ON THE NUCLEAR INTERACTIONS OF THE RELATIVISTIC μ MESON. Dan Kessler and Paul Kessler. Compt. rend. 242, 3045-7(1956) June 25. (In French)

An attempt was made to interpret μ-meson reactions using quantum field theory. Results are in good agreement with those of Williams and Weizsacher, who used a semi-classical method of interpretation. (B.J.H.)

10365

CLOUD CHAMBER OBSERVATIONS OF NEGATIVE HEAVY MESONS. E. G. Michaelis (Birkbeck Coll., London) and B. W. Powell (Univ. of Manchester, England). Phil. Mag. (8) 1, 441-9(1956) May.

Earlier work by the Manchester Jungfraujoch group on slow, negative, heavy cosmic-ray particles observed in a magnet cloud chamber has been repeated. An upper limit to the frequency of slow K^- mesons which do not decay in the cloud chamber is now found to be $\sim 1\%$ of the frequency of slow protons. From other published data, the probable ratio of the two frequencies is estimated as about 1 : 2000. The identity of the observed particles is discussed. The previous results giving a high frequency and a long mean lifetime for K^- mesons are not confirmed. One event showing the possible simultaneous production of two slow K^- mesons and one example of an upward-moving S^+ particle are described. (auth)

10366

PRODUCTION OF A θ^0 PARTICLE WITHOUT AN ASSOCIATED HYPERON IN A $\pi^- - p$ COLLISION. William B. Fowler, George Maenchen, Wilson M. Powell, George Saphir, and Robert W. Wright (Univ. of California, Berkeley). Phys. Rev. 103, 208-10(1956) July 1.

An event is described that is interpreted as evidence for the simultaneous production of a θ^0 and a $\bar{\theta}^0$ according to the scheme of Gell-Mann and Pais. This interpretation assumes the production of a normal θ^0 and a K^0 with no associated hyperon, where the θ^0 is observed and the K^0 is inferred from the rule of associated production of heavy unstable particles. The event was obtained by exposing a high-pressure diffusion cloud chamber to a 4.5-Bev/c π^- meson beam from the Bevatron. The event is most reasonably interpreted as $\pi^- + p \rightarrow \pi^- + p + \theta^0 + (\text{neutral})$. Energy and momentum conservation are satisfied by an undetected neutral particle having a mass of 502_{-124}^{+91} Mev. This is consistent with the associated production of a θ^0 and a $\bar{\theta}^0$ according to the scheme of Gell-Mann and Pais. Details are given and alternative interpretations are discussed. (auth)

10367

MASS OF THE Σ^+ HYPERON. W. F. Fry, J. Schneps, G. A. Snow, and M. S. Swami (Univ. of Wisconsin, Madison). Phys. Rev. 103, 226-7(1956) July 1.

Ten examples of the protonic decay from rest of the Σ^+ hyperon have been analyzed. The ranges of the protons from the Σ^+ decays were corrected for variations in the stopping power of each emulsion batch by determining the mean range of μ mesons from $\pi - \mu$ decays. The mean range of the protons, after correcting for variations in stopping power, was found to be 1669.4 ± 8.0 microns. The rms deviation of the proton ranges was found to be 38.5 ± 8.0 microns. The Q of the Σ^+ decay, $\Sigma^+ \rightarrow p + \pi^0$ is 116.1 ± 0.5 Mev, and the mass of the Σ^+ hyperon is $(2327.4 \pm 1.0)m_e$. (auth)

10368

TWO HYPERFRAGMENTS FROM NEGATIVE K-PARTICLE CAPTURE AND THE MASS OF THE NEGATIVE K PARTICLE. Francis C. Gilbert, Charles E. Violet, and R. Stephen White (Univ. of California, Berkeley and Livermore). Phys. Rev. 103, 248-9(1956) July 1.

Two hyperfragments are described which have been found from 81 negative K-particle interactions at rest and in flight. Event 35 was identified as a K^- capture in carbon which emitted a ${}_\Lambda Li^7$ hyperfragment that decayed into a π^- meson and a Be^7 fragment. The binding energy of the Λ hyperon in ${}_\Lambda Li^7$ was found to be 4.4 ± 0.7 Mev. The mass of the negative K particle which was captured in this reaction was found to be 966.2 ± 5.0 electron masses. In Event 71, a negative K particle was captured in a light nucleus. Four charged particles and a π^- meson and a hyperfragment, ${}_\Lambda He^4$, left the K^- ending. The ${}_\Lambda He^4$ decayed into a proton, a π^- meson, and a He^3 fragment. The binding energy of the Λ hyperon in ${}_\Lambda He^4$ was found to be 1.5 ± 0.6 Mev. (auth)

10369

THEORY OF PION PHOTOPRODUCTION. Marc Ross (Indiana Univ., Bloomington). Phys. Rev. 103, 760-76(1956) Aug. 1.

The photoproduction of pions from nucleons is calculated in the Tamm-Dancoff approximation to the relativistic pseudoscalar theory. The matrix elements are explicitly separated, in each partial wave, into production into plane waves

and production associated with final-state scattering. These matrix elements are exhibited and compared in the energy region up to 500 Mev. The agreement between theory and experiment is fairly good if one uses the same coupling constant used to calculate scattering in this approximation. The enhancement of the $P_{3/2}$, $T = 3/2$ (M1) matrix element is about 2.5. A correction for the nonconservation of isotopic spin due to the $\pi^+ - \pi^0$ mass difference is evaluated. (auth)

10370

ANNIHILATION OF ANTINUCLEONS. George Sudarshan (Univ. of Rochester, N. Y.). Phys. Rev. 103, 777-81(1956) Aug. 1.

In this note, the expected π- and K-meson multiplicities resulting from the annihilation of a nucleon pair at rest have been calculated on the basis of two versions of the statistical theory: the Fermi and the Pomeranchuk-Landau models. The Fermi model yields smaller pion multiplicities and larger probabilities for K-meson pairs than does the Pomeranchuk-Landau model. (auth)

10371

DECAY OF BOUND Λ^0-PARTICLES. G. Eder (Max-Planck-Institut fur Physik, Gottingen). Nuovo cimento (10) 3, 880-4(1956) May. (In German)

10372

STAR PRODUCED BY THE CAPTURE OF A HYPERON Σ^-. Tsai-Chii (Faculte des Sciences, Sorbonne, France). Nuovo cimento (10) 3, 921-9(1956) May.

A flat track of 876 μm emitted from a primary star of 19 prongs came to rest in the emulsion and produced a small star of three prongs. Direct mass determinations of the above track give 2830 ± 560 m_e by ionization and 2560 ± 790 m_e by scattering. Two prongs of the secondary star can be identified as α-particles; the star has a visible energy of 18 Mev. The small star has been explained by the reaction $\Sigma^- + p \rightarrow \Lambda^0 + n$; the capture of a negative hyperon by a proton inside a nucleus with a few low energy nucleons knocked out of the target nucleus. The present event may be the break-up of a light nucleus by the neutron and Λ^0. (auth)

10373

KINEMATICS OF THE REACTION $K + p \rightarrow \pi + \Sigma$ AND OF THE ELASTIC SCATTERING $K + p \rightarrow K + p$. E. Pedretti (Istituto di Fisica dell'Universita, Bologna). Nuovo cimento (10) 3, 958-67(1956) May.

To facilitate the identification of K-mesons interactions, particularly in G5 emulsion, the kinematics of the reaction $K + p \rightarrow \pi + \Sigma$ and of the scattering $K + p \rightarrow K + p$ have been calculated and plotted for various kinetic energies of the incident K-meson. (auth)

10374

THE EVIDENCE FROM ANGULAR CORRELATIONS ON THE SPIN OF THE Λ^0. G. Morpurgo (Scuola di Perfezionamento in Fisica Nucleare dell'Universita, Rome). Nuovo cimento (10) 3, 1069-92(1956) May.

A method for establishing a lower limit to the spin of the Λ^0 is described; the method is based on the observation that the possible simultaneous shapes of the two angular distributions in cos θ and φ (φ = angle between the plane of production and the plane of decay; θ angle between the line of flight of the Λ^0 and the line of flight of the decay products in the rest system of the same) are, for any assumed spin connected with each other and severely restricted. A detailed analysis is presented, for the cases of spins $3/2$ and $5/2$. The insufficient statistics of the experimental data presently available does not allow at the moment to express any definite conclusion. However if some trends now present in the data will be confirmed a spin of $5/2$ or higher is necessary. (auth)

10375

A MODEL FOR $\Lambda^0 - \theta^0$ PRODUCTION. L. F. Landovitz and J. Leitner (Columbia Univ., New York). Nuovo cimento (10) 3, 1093-1103(1956) May.

A calculation of the perturbation theoretical angular distributions in the reaction $\pi^- + p \rightarrow \Lambda^0 + \theta^0$ is reported. Some general implications of the model $\pi^- + p \rightarrow$ single particle $\rightarrow \Lambda^0 + \theta^0$ are described. The second order results for the productions distributions are of the form $A + B \cos \theta$ for all choices of spin, coupling, etc. The exact center of mass distribution is identical in form to that above but is determined only to within an unknown parameter ξ. The nature of the distributions preclude the possibility of verification of the model on the basis of present data. The decay angular distributions of the spin $1/2$ Λ^0 are isotropic for all values for the θ^0 spin. Possibilities for future comparison with experiment are discussed. (auth)

10376

ON THE PION-NUCLEON INTERACTION. P. Budini (Istituto di Fisica dell'Universita, Trieste). Nuovo cimento (10) 3, 1104-11(1956) May.

A non local model for the pion-nucleon interaction is presented assuming that the pion interacts with the nucleon through an intermediate field. This internal field provides factors in the integral equations of the pion nucleon scattering which play the role of the usual mathematical form factors of the non local theories. With a proper choice of the mass of the internal quanta and of the coupling-constant and after renormalization of the integral equations on the Chew scheme the known behavior of the P phases of pion nucleon scattering at low energy can be reproduced. (auth)

10377

ON Λ^0-BINDING ENERGIES IN HYPERFRAGMENTS. T. Tati and H. Tati (Kanazawa Univ., Japan). Nuovo cimento (10) 3, 1136-9(1956) May.

Nucleon and Λ^0 binding energies are discussed. Plots of these energies are given which show the Λ^0 energy as a smooth function of the fragment mass, while the nucleon binding energy is shown to vary with N and Z. Explanations for these differences are proposed. (D.E.B.)

10378

A τ-DECAY WITH A SECONDARY OF EXTREMELY LOW ENERGY. N. Brene (Univ. of Copenhagen, Denmark). Nuovo cimento (10) 3, 1140-1(1956) May.

A π^+meson from a τ decay having a range of only 12.0 ± 1.0 μm in nuclear emulsion is reported. The energy is reported as 467 ± 25 kev. (D.E.B.)

10379

REMARKS ON THE ABSORPTION OF NEGATIVE K-MESONS BY PROTONS. R. Gatta (Istituto di Fisica e Scuola di Perfezionamento dell'Universita, Rome). Nuovo cimento (10) 3, 1142-4(1956) May.

A number of different modes of K^- absorption by protons are given. The angular correlations of the decay products are considered for spin information. The possibility of absorption from orbits of higher angular momentum is discussed. (D.E.B.)

10380

ON THE MASS OF THE K^--MESON. F. Hanni, Ch. Lang, M. Teucher, and H. Winzeler (Physikalisches Institut der Univer Universitat, Bern, Switzerland) and E. Lohrmann (Hochspannungslaboratorium Hechingen, Deutschland). Nuovo cimento (10) 3, 1169-70(1956) May.

Measurements on an emulsion star indicate a K^- mass of 979 ± 11 m_e. This is compared with a previously reported value of 963 ± 12 m_e. (D.E.B.)

10381

PROBABLE EVIDENCE FOR Y_ρ-EVENTS. C. Castagnoli, C. Franzinetti, and A. Manfredini (Istituto di Fisica dell'Universita, Rome). Nuovo cimento (10) 3, 1259-61(1956) May.

Two events were observed which appear to be Y-particles

which were stopped in an emulsion without decaying or producing a visible disintegration. Tracks and mass measurements are given and discussed. (D.E.B.)

Refer also to abstract 10569.

METEOROLOGY

10382 CWLR-2046
Chemical Warfare Labs., Army Chemical Center, Md.
DEPOSITION OF AIRBORNE PARTICLES ON A LARGE HEATED SURFACE. Martin Harwit. Feb. 1956. 35p. Project No. 4-12-10-007-04.

The effect of a large heated surface on the deposition pattern from a polluted atmosphere is studied. It is concluded that the use of heat to avert the deposition of particulate matter 20μ to 300μ is not practical. (auth)

10383
FLUCTUATIONS OF NATURAL RADIOACTIVITY OF THE AIR; MEASUREMENT AT 2600 m ABOVE SEA LEVEL IN THE NORTHERN ALPS. Reinhold Reiter. Z. Naturforsch. 11a, 411-18(1956) May. (In German)

MOLECULAR PROPERTIES

10384 CCC-1024-TR-196
Callery Chemical Co., Penna.
A MASS SPECTROMETRIC APPEARANCE POTENTIAL STUDY OF DIBORANE. J. L. Margrave—P. M. Maginnity, ed. Aug. 8, 1956. 10p. Contract [NOa(s)-52-1023-c].

The appearance potentials of all the important singly charged positive ion fragments formed on bombarding diborane with electrons have been measured. Also, the appearance potentials of some doubly charged species have been approximately determined. The ionization potential of diborane was found to be 12.1 ± 0.2 ev. (auth)

10385
RADIATION OF MOLECULES IN THE PRESENCE OF A STRONG HIGH-FREQUENCY FIELD. V. M. Fain (Gorki State Univ.). Soviet Phys. JETP 2, 747-9(1956) July. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 878-80(1955) Dec. (In Russian)

It is shown that a radiation appears at a frequency Ω_0 which depends on the matrix element of the dipole moment corresponding to the transition $E_1 \rightarrow E_2$ (where E_1 and E_2 are energy levels of the molecules) and on the field potential of the frequency $\omega \approx \omega_{\frac{1}{2}} = (E_1 - E_2)/h$. (B.J.H.)

10386
PHOSPHORESCENCE OF THE CRYSTAL PHOSPHOR ZnS–Cu DURING EXCITATION BY AN ELECTRON BEAM. T. P. Belikova (P. N. Lebedev Physical Inst., Academy of Sciences, U.S.S.R.). Soviet Phys. JETP 2, 776-7(1956) July. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 905-6 (1955) Dec. (In Russian)

The continuous decay of luminescence of a ZnS–Cu phosphor was measured during excitation by an electron beam and, for comparison, under excitation by light with λ = 365 mμ. It was shown that the decay takes place nonspecifically with regard to the type of excitation and that the difference in observed decay curves can be explained by the difference in density of excitation during the various types of excitation. (B.J.H.)

NEUTRONS

10387 AERE-T/M-53
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
A PROBLEM IN THE SLOWING DOWN AND DIFFUSION OF NEUTRONS IN HYDROGENEOUS MEDIA WITH COMPLEX GEOMETRY. K. T. Spinney. Dec. 10, 1951. 27p.

A problem is described which entails the calculation of the spatial distribution of neutrons in a half space consisting of two media (concrete and Pb) and a cavity. At large distances from a source of fast neutrons in concrete or similar hydrogeneous medium, the density of fast neutrons is governed by those which have escaped collision with H. Diffusion theory may be applied to these, with suitable choice of relaxation length and this method is used to solve the problem for fast neutrons together with a further application of diffusion theory to find the flux of thermal neutrons. (auth)

10388 AERE-T/R-287
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
MEASUREMENT OF DIFFUSION LENGTH IN A LARGE BLOCK OF GRAPHITE. M. E. Clifford. Jan. 7, 1949. 9p.

The distribution of thermal neutrons due to a source of fast neutrons in a large homogeneous block of graphite is considered in order to determine where measurement of the flux of thermal neutrons is possible and the nature of the boundary and source container effects. A method is given for calculating the diffusion length from the measurements. (auth)

10389
SOME EFFECTS OF THE SELF-ABSORPTION OF NEUTRONS IN NEUTRON-DETECTING FOILS. M. W. Thompson (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 2, 286-90(1956) June.

The distortion of neutron flux by detecting foils is discussed and a method described by which it has been measured. The results, which are compared with theory, show how the mean distorted flux changes with foil-thickness for idium foils in different graphite-pile spectra. From these results the effect of a change in irradiation spectrum on the intercalibration of foils is calculated. The interaction of two indium foils in the same graphite system has been studied experimentally. (auth)

10390
CALCULATION OF NEUTRON RADIATIVE CAPTURE CROSS SECTIONS. Lawrence Dresner (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 1, 103-7 (1956) May.

Several methods of calculating radiative capture cross sections are compared, and numerical results are given for U^{238}. The importance of neutron angular momenta higher than zero is found to be large at quite low energies. (auth)

10391
THE INTERPRETATION OF THE GIANT RESONANCES IN THE ELASTIC SCATTERING OF NEUTRONS BY NUCLEI. L. Verlet (Laboratoire de Physique, École Normale Supérieure). J. phys. radium 17, 562(1956) July. (In French)

The Wigner, Lane and Thomas model is generalized so as to lower the second moment of the distribution of the reduced widths to (9 Mev)^2. (auth)

10392
MONOENERGETIC NEUTRON TECHNIQUES IN THE 10- TO 30-MEV RANGE. J. L. Fowler (Oak Ridge National Lab., Tenn.) and John E. Brolley, Jr. (Los Alamos Scientific Lab., N. Mex.). Revs. Mod. Phys. 28, 103-34(1956) Apr.

A review is given of the techniques for detection of 10- to 30-Mev monoenergetic neutrons with emphasis being placed on absolute neutron flux measurements. Charged particle reactions, which result in monoenergetic neutrons, are discussed; the published cross-section data for the

neutron producing reactions involving the hydrogen isotopes are collected and presented as a function of energy and angle. Sources of background neutrons are considered. Tables of neutron energies including relativistic effects for the hydrogen isotope reactions are presented. (auth)

10393

REACTOR PHYSICS. 2. James F. Hill. Nuclear Power 1, 65-9(1956) June.

The behavior of thermal neutrons is discussed by first demonstrating that they obey the Maxwell distribution of velocities, and the important properties of this distribution are given. It is then shown that thermal neutrons can be assumed to have a constant velocity. From this assumption, their behavior in contact with matter can be studied. This is done by first defining a neutron cross-section. Then the consequence of this on the attenuation of a beam of neutrons penetrating matter is found. This result is then used to calculate the neutron current, which is the net number of neutrons crossing unit area in unit time. Finally, the neutron diffusion equation is derived. This equation describes the variation of the neutron flux (neutron density multiplied by velocity) in a system as a function of the space co-ordinates and of the time. (auth)

Refer also to abstracts 10560, 10565, and 10683.

NUCLEAR PHYSICS

10394

RELAXATION PROCESSES IN THE INTERACTION OF NUCLEAR MAGNETIC MOMENTS WITH AN OSCILLATOR LOOP. N. M. Pomerantsev (Moscow State Univ.). Soviet Phys. JETP 2, 581-2(1956) May. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 375-6(1955) Sept. (In Russian)

10395

THE FERMI-YANG HYPOTHESIS. S. S. Filippov (Inst. of Nuclear Problems, Academy of Sciences of the U.S.S.R.). Soviet Phys. JETP 2, 572-3(1956) May. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 707-8(1955) Nov. (In Russian)

The series of particles with mass intermediate between nucleons and π mesons is considered from the point of view of the Fermi-Yang hypothesis, i.e., as nucleon-antinucleon systems in bound states. The interaction potential obtained in this case is compared to the potential obtained by Fermi and Yang by considering the π meson as a composite particle. (B.J.H.)

10396

DEPENDENCE OF ALPHA DISINTEGRATION ENERGY ON PROTON AND NEUTRON NUMBERS. Y. Pal Varshni (Allahabad Univ., India). Nuovo cimento (10) 3, 1148-9(1956) May.

A simple empirical relation for α disintegration energy in terms of N and Z for nuclei having N > 132 is given. Calculated values are tabulated and compared with observations. (D.E.B.)

10397

PHASE SHIFT ANALYSIS OF PION-NUCLEON SCATTERING EXPERIMENTS. I. GENERAL OUTLINE. E. Clementel and C. Villi (Univ. of Padova and Univ. of Trieste). Nuovo cimento (10) 3, Suppl. No. 3, 474-89(1956). (In English)

The methods used to determine pion-nucleon phase shifts are briefly outlined. The Anderson-Bethe and Fermi-Metropolis solutions for positive pion scattering are reviewed, as are the Steinberger solutions for scattering in the $T=\frac{1}{2}$ state. The D-wave contribution in positive pion-nucleon scattering is also discussed. (B. J. H.)

10398

PRODUCTION AND ANNIHILATION OF AN ANTIPROTON IN A NUCLEAR EMULSION. R. D. Hill, Stig D. Johansson, and F. T. Gardner (Univ. of Illinois, Urbana). Phys. Rev. 103, 250-3(1956) July 1.

A track connecting two high-energy stars in a nuclear emulsion has been identified as an antiproton. Ionization density and scattering measurements on the track indicate that the antiproton's energy was 710 ± 150 Mev, whereas the energy in the secondary star caused by the antiproton was certainly greater than 1460 Mev. The stars in which the antiproton originated and was annihilated are described. (auth)

10399

CONSEQUENCES OF CHARGE INDEPENDENCE FOR STRANGE-PARTICLE REACTIONS. David Feldman (Univ. of California, Berkeley). Phys. Rev. 103, 254-7(1956) July 1.

The implications of isotopic-spin conservation for fast strange-particle reactions, especially the production processes as well as the K-particle interactions with nuclei, have been investigated. The possibility of distinguishing the Gell-Mann, Pais, and Salam-Polkinghorne theories of strange particles is also discussed. (auth)

10400

SELECTION RULES FOR N $\overline{\text{N}}$ ANNIHILATION. Charles Goebel (Univ. of California, Berkeley). Phys. Rev. 103, 258-61(1956) July 1.

Selection rules governing the annihilation of a nucleon-antinucleon pair into pions, photons, and heavy mesons are derived from the conservation of angular momentum, parity, charge parity, and isotopic spin. Special attention is given to the probability of annihilation purely into neutral pions. (auth)

10401

INTERACTION CONTRIBUTION TO NUCLEAR ISOMERISM. Larry Spruch and Aubey Rotenberg (New York Univ.). Phys. Rev. 103, 365-73(1956) July 15.

A number of observed magnetic multipole isomeric transitions are forbidden on a strict Mayer model of the nucleus, and even on a number of variations thereof, if the ordinary magnetic moment operator is used. Possible explanations include modifications of the nuclear model, of the magnetic moment operator, or of both. Modifications of the operator involve consideration of the currents due to the exchange of mesons between nucleons which give rise to interaction contributions to the magnetic moment operator. An exploratory investigation has been carried out to see to what extent these interaction effects by themselves can account for these so-called forbidden transitions. Using certain simplicity arguments the operators were chosen from the set which can be written down, phenomenologically, with the radial functions arbitrary. The dipole calculations were performed on both the Fermi model and the shell model. On the Fermi model, the transition matrix element involves the unknown radial function only in an integral which is identical for all transitions. By an appropriate but arbitrary choice of the numerical value of this integral, the data can be accounted for, though somewhat crudely; the difference between transitions in odd-proton and odd-neutron nuclei is not explained. There are very few data on "forbidden" octupole transitions; the data that do exist can be more or less understood in terms of the interaction moments. (auth)

10402

NEUTRON-ELECTRON INTERACTION IN CUTOFF THEORY. S. B. Treiman and R. G. Sachs (Princeton Univ., N. J.). Phys. Rev. 103, 435-9(1956) July 15.

The perturbation-theoretic result for the neutron-

electron interaction, as calculated by Salzman in the Chew no-recoil theory, is in serious disagreement with experiment. The main part of the experimental interaction (~4.2 kev) is accounted for by the Foldy term (4.08 kev). But the latter is not included in the no-recoil approximation, where one calculates only the electron interaction with the static pion cloud of the physical neutron. For this part of the interaction the no-recoil perturbation result is too large by a factor of at least twenty. An investigation was made of the possibility that higher order corrections drastically alter the pion cloud charge distribution. Using the techniques developed by Miyazawa, one can express the higher order corrections in terms of weighted integrals over the pion-nucleon interaction cross sections. It is found that the higher order effects indeed reduce the pion cloud contribution, but only by 20 percent. Because of certain ambiguities involved in treating the cutoff function, it cannot be stated that this represents the true content of Chew's theory; but it seems unlikely that any reasonable treatment of the cutoff could reduce the discrepancy much further. (auth)

10403

BREMSSTRAHLUNG IN HIGH-ENERGY NUCLEON-NUCLEON COLLISIONS. R. E. Cutkosky (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 103, 505-6(1956) July 15.

Methods for calculating the bremsstrahlung in high-energy nucleon-nucleon collisions are briefly discussed. (B.J.H.)

10404

TEST OF THE STATISTICAL ASSUMPTION IN NUCLEAR REACTIONS. R. M. Eisberg and N. M. Hintz (Univ. of Minnesota, Minneapolis). Phys Rev. 103, 645-6(1956) Aug. 1.

The angular distribution of protons inelastically scattered from A^{40}, leading to the excitation of the 1.47-Mev level, has been measured at bombarding energies of 9.8, 9.0, and 8.5 Mev. An attempt is made to relate these data to the possibility of correlations in the phases of the levels excited in the compound nucleus. (auth)

10405

SEMIEMPIRICAL MODEL FOR DIRECT NUCLEAR BREAK-UP REACTIONS. Mendel Sachs (Univ. of California Radiation Lab., Livermore). Phys. Rev. 103, 671-3(1956) Aug. 1.

A semiempirical model describing the direct breakup of light nuclei by low-energy nucleons is proposed. The model is based upon the assumption that a statistical equilibrium is established with respect to the incident particle and (v−1) tightly bound subgroup components of the target nucleus inside of an energy-dependent interaction volume. The interaction volume is taken to be an oblate spheroid which is oriented along the direction of the incident particle path, and which has a minor axis equal to the de Broglie wavelength λ, and a major axis equal to $(R + a\lambda)$, where R and a are parameters characteristic to the particular reaction involved. The direct breakup cross section is calculated for the $Be^9(n,2n)Be^8$ and $C^{12}(n,n')3He^4$ reactions. (auth)

10406

NUCLEAR BINDING ENERGIES IN THE SHELL MODEL. I. Talmi and R. Thieberger (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Rev. 103, 718-20(1956) Aug. 1.

Nuclear binding energies are calculated from a general two-body interaction by using jj-coupling shell model wave functions for the nucleons. The good agreement obtained indicates that the effective central field in which the nucleons move is the same for all nuclei in which the same shell is being filled. (auth)

10407

REORIENTATION EFFECT IN COULOMB EXCITATION. G. Breit, R. L. Gluckstern, and J. E. Russell (Yale Univ., New Haven, Conn.). Phys. Rev. 103, 727-38(1956) Aug. 1.

The semiclassical treatment of the effect of the reorientation of the spin of the target nucleus during a collision resulting in Coulomb excitation is presented. It is found that the effect vanishes for zero excitation, but that it may be appreciable for finite excitation. The effect on the angular distribution of the photons is similarly found to vanish for head-on collisions. Three different types of experiments involving the measurement of the angular distribution of the photons are discussed. Typical numerical results for comparison with experiment are presented and the possibilities offered by bombardment with heavy ions are noted. (auth)

10408

ELECTROMAGNETIC ANNIHILATION OF ANTIPROTONS. Laurie M. Brown and Murray Peshkin (Northwestern Univ., Evanston, Ill.). Phys. Rev. 103, 751-2(1956) Aug. 1.

The familiar model of a nucleon as a Dirac particle with Pauli anomalous magnetic moment is used to obtain cross sections for antiproton annihilation into two photons, two electrons, or two muons. The two-photon lifetime of the n $^1S_0$ state of the proton-antiproton atom is $\approx 2 \times 10^{-15} n^3$ sec. (auth)

10409

EFFECT OF MELTING ON POSITRON LIFETIME. H. S. Landes, S. Berko, and A. J. Zuchelli (Univ. of Virginia, Charlottesville). Phys. Rev. 103, 828-9(1956) Aug. 1.

Positron annihilation lifetimes of 2 to 3×10^{-10} and 1 to 4×10^{-9} sec have been measured. The number of annihilations having the shorter lifetime is dependent upon the crystalline structure of the annihilation medium. This dependence is plotted for annihilation in naphthalene across the solid-liquid transition. (D.E.B.)

10410

GROUND STATE ENERGY OF TWO-ELECTRON ATOMS. Egil A. Hylleraas and John Midtdal (Univ. of Oslo, Norway). Phys. Rev. 103, 829-30(1956) Aug. 1.

Nonrelativistic energies for the ground states of a list of light ions and atoms were recalculated by means of an electronic computer, using 18 and 24 terms in the wave functions. (D.E.B.)

10411

EMPIRICAL DETERMINATION OF NUCLEAR MOMENTS OF INERTIA AND INTRINSIC QUADRUPOLE MOMENTS. E. D. Klema and R. K. Osborn (Oak Ridge National Lab., Tenn.). Phys. Rev. 103, 833-4(1956) Aug. 1.

An empirical parameter was found which permits the calculation of the fraction of nuclear mass or charge taking part in collective phenomena for even-even nuclei. The function of this parameter, based on a ratio of nucleons outside filled shells to total nucleons, is discussed, and a table of intrinsic quadrupole moments for even-even nuclei from Gd to W obtained through the use of the parameter is given. (D. E. B.)

10412

OBSERVATION OF NUCLEAR MAGNETIC RESONANCES VIA THE ELECTRON SPIN RESONANCE LINE. G. Feher (Bell Telephone Labs., Inc., Murray Hill, N. J.). Phys. Rev. 103, 834-5(1956) Aug. 1.

The double-frequency resonance method with a nuclear polarization scheme was extended to observe nuclear transitions and determine hyperfine interactions and g values. The method is illustrated for the case $I = \frac{1}{2}$, $J = \frac{1}{2}$, in which the hyperfine structure is resolved. (D.E.B.)

10413

REGULARITIES IN THE LEVEL SCHEMES OF HEAVY EVEN-EVEN NUCLEI. G. Scharff-Goldhaber (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 103, 837-8(1956) Aug. 1.

The energies of the E_1 states of even-even nuclei with Z > 82 and N ≥ 126 are plotted against N and Z, showing a rapid decrease with increasing Z. This plot is compared with plots of the ratio E_1 to E_2 against Z and N which show increases at Z = 86 to 88 and N = 88 to 90. (D.E.B.)

10414

TABLE OF PROPERTIES OF THE "ELEMENTARY" PARTICLES. Anatole M. Shapiro (Harvard Univ., Cambridge, Mass.). Revs. Mod. Phys. 28, 164-70(1956) Apr.

NUCLEAR PROPERTIES

10415 BNL-400

Brookhaven National Lab., Upton, N. Y.

NEUTRON CROSS SECTIONS: ANGULAR DISTRIBUTIONS. Donald J. Hughes and Robert S. Carter. June 1956. 104p. $0.50(OTS).

An expansion of data contained in BNL-325.

10416 NAA-SR-1641

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

TEMPERATURE COEFFICIENTS OF URANIUM AND THORIUM RESONANCE INTEGRALS. G. W. Rodeback. Sept. 1, 1956. 25p. Contract AT(04-3)-49. $0.25(OTS).

The temperature coefficients of the effective resonance integrals of U^{238} and Th^{232} have been determined by a comparison of their respective epicadmium neutron activations over a range of temperatures. Measurements were made with $^3/_4$-inch diameter cylinders having surface-to-mass ratios of 0.117 cm^2/gm for U and 0.189 cm^2/gm for Th. The following values for the temperature coefficients of the epicadmium activation result: for U, +0.8% ± 0.2% per 100°C measured from 20 to 660°C; for Th, +2.0% ± 0.3% per 100°C measured from 20 to 775°C. (auth)

10417 ORO-151

Arkansas. Univ., Fayetteville.

ELECTROMAGNETIC RADIATIONS OF CESIUM 132. Berol L. Robinson and Richard W. Fink. July 1956. 19p. Contract AT(40-1)-277. $0.20(OTS).

A sample of Cs^{132} was prepared by bombarding CsCl with 80-Mev protons in the Rochester 130-inch cyclotron followed by radiochemical purification. The half life was 6.2 ± 0.2 days by gamma counting. Scintillation spectrometer studies showed gamma rays at 669 ± 3 kev, 1100 ± 40 kev, and 1265 ± 20 kev, having intensities of 1000:(7 ± 2):(8 ± 2), respectively. By means of K x-ray–gamma coincidence experiments, the branching ratio to the 669-kev level was found to be 0.9 ± 0.2. Major sources of error in this measurement arise from uncertainties in the absolute calibration of a Cs^{137} standard, and in the decay constants of Cs^{132} and Cs^{131}, the latter being present as a contaminant. From the branching ratio, it is deduced that electron capture to the ground-state is forbidden and that Cs^{132} has I ≥ 2, in agreement with shell model predictions. Because of ft value shows the transition to the 669-kev level to be allowed, the spin must be less than 4. Gamma–gamma coincidences were observed, but the 1265-kev gamma ray is not coincident with the 669-kev transition. Gamma rays at 395 ± 10 kev and 550 ± 30 kev were observed and are attributed to Cs^{129}, as they decayed with a half life of about 31 hours. (auth)

10418

NUCLEAR SPINS OF Dy^{163} AND Dy^{161}. Kiyoshi Murakawa (Inst. of Science and Tech., Tokyo). J. Phys. Soc. Japan 11, 804-5(1956) July.

Hyperfine structure analysis indicates a spin of $^3/_2$ for both Dy^{161} and Dy^{163}. (D.E.B.)

10419

THE DISTRIBUTION COEFFICIENT OF ^3He–^4He MIXTURES OF LOW CONCENTRATION AT TEMPERATURES BETWEEN 1.2 AND 2°K. D. H. N. Wansink, K. W. Taconis, and F. A. Staas (Kamerlingh Onnes Laboratorium, Leiden, Netherlands). Physica 22, 449-64(1956) May.

Measurements have been made of the ratio of the vapor and the liquid concentration, C_V/C_L, of He^3 and He^4 mixtures of very low concentrations at temperatures between 1.2 and 2°K. The distribution coefficient is given as a function of the liquid concentration at various temperatures. (F. S.)

10420

RESONANCE ACTIVATION INTEGRALS OF U^{238} AND Th^{232}. R. L. Macklin and H. S. Pomerance (Oak Ridge National Lab., Tenn.). J. Nuclear Energy 2, 243-6(1956) June.

Resonance activation integrals of 281 ± 20 b for U^{238} and 67 ± 5 for Th^{232} were found by comparing induced beta activities with Au^{197}, the resonance integral for the last being taken as 1513 b. The ratio of the U^{238} to Th^{232} integrals is 4.20 ± 0.16. The specific alpha activity of the alpha groups near 3.98 Mev leads to a half life of $(1.45 \pm 0.05) \times 10^{10}$ yr for Th^{232}. (auth)

10421

A MEASUREMENT OF THE HALF-LIFE OF Pu^{241}. B. Rose and J. Milsted (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 2, 264-76(1956) June.

By studying the growth of the gamma activity of the daughter Am^{241} in a xenon-filled proportional counter, a value of 12.95 ± 0.28 years was found to be the half life of Pu^{241}. (F. S.)

10422

A METHOD FOR MEASURING THE POLARIZATION OF NUCLEAR REACTION PRODUCTS. H. H. Barschall (Univ. of Wisconsin, Madison). Helv. Phys. Acta 29, 145-6(1956) May. (In English)

A method for measuring the polarization of nuclear reaction products is proposed in which the reverse reaction is used for analysis. (auth)

10423

THERMAL NEUTRON CAPTURE CROSS SECTION OF Ce^{142}. L. P. Roy and L. Yaffe (McGill Univ., Montreal, Canada). Can. J. Chem. 34, 1023-6(1956) Aug.

The cross section of Ce^{142} was determined by the activation method and found to be 0.95 ± 0.05 barns, assuming σ Co^{59} = 36.3 barns. (C.W.H.)

10424

MULTIPOLE LINES IN THE FIRST SPECTRUM OF POLONIUM I. S. Mrozowski (Univ. of Buffalo, N. Y.). J. Opt. Soc. Amer. 46, 663(1956) Aug.

10425

QUADRUPLE RELAXATION IN NUCLEAR MAGNETIC RESONANCE OF LIQUIDS. Joseph Seiden. Compt. rend. 242, 2715-18(1956) June 4. (In French)

10426

ON THE PRESENCE OF DIFFERENT INSTANTANEOUS SUB-STRUCTURES IN THE C^{12} NUCLEUS. Adham Samman. Compt. rend. 242, 3062-4(1956) June 25. (In French)

Twenty-seven disintegrations of the type $C^{12} + p \rightarrow p' + 3\alpha$ were studied in detail. Eight among them can be explained completely by a direct collision and a unique $p \rightarrow \alpha$ (bound to C^{12}). Nine others arise from the collision $p \rightarrow$ bound nucleon, three from the collision $p \rightarrow {}^2M$ bound; three from the collision $p \rightarrow {}^3M$ bound, and finally four others involve multiple collisions of the proton with the particles bound to C^{12}. (tr-auth)

10427

ELECTROMAGNETIC INTERACTIONS OF μ MESONS AT GREAT DEPTHS—DIRECT CREATION OF ELECTRON PAIRS. Madeleine Avan and Louis Avan. Compt. rend. 243, 38-41(1956) July 2. (In French)

Measurements were made of the effective cross section $(^{e}T)_{\mu}$ for direct pair creation by μ mesons in nuclear emulsions exposed underground. Comparisons were made to theoretical values given by the Born approximation of Bhabha's theory. Experimental values for the cross section are: at 300 m H_2O, $(^{e}T)_{\mu} = (0.72 \pm 0.16) \times 10^{-25}$ cm^2 per emulsion nucleus; and at 580 m H_2O, $(^{e}T)_{\mu} = (0.92 \pm 0.22) \times 10^{-25}$ cm^2 per emulsion nucleus. (B.J.H.)

10428

NEUTRON INELASTIC CROSS-SECTIONS BETWEEN 55 AND 140 MEV. R. G. P. Voss and R. Wilson (Univ. of Oxford, England). Proc. Roy. Soc. (London) A236, 41-51(1956) July 10.

The neutron inelastic cross-sections for Pb, Cd, Cu, Al and C have been measured at 104, 105, 81, and 55 Mev, by using a large liquid scintillation counter in a bad-geometry experiment. At the lower energies the cross-sections decrease monotonically with increase in energy, but thereafter remain practically constant as the energy is increased. (auth)

10429

THE ANALYSIS OF HIGH-ENERGY NEUTRON CROSS-SECTIONS. R. G. P. Voss and R. Wilson (Univ. of Oxford, England). Proc. Roy. Soc. (London) A236, 52-67(1956) July 10.

The neutron inelastic cross-sections reported in the previous paper are interpreted in terms of the square-well and harmonic oscillator optical models, and also the tapered density distribution. Neutron and proton inelastic cross-sections are compared, and are shown to suggest that the neutrons in a nucleus have a larger spatial distribution than the protons. Finally, neutron total cross-sections are used to put an upper limit to the permissible surface thickness of a nucleus. (auth)

10430

DISINTEGRATIONS PRODUCED IN THE LIGHT ELEMENTS OF NUCLEAR EMULSIONS BY 950 MEV PROTONS. R. McKeague (Queen's Univ. of Belfast). Proc. Roy. Soc. (London) A236, 104-11(1956) July 10.

Ilford G 5 photographic emulsions have been exposed to 950 Mev protons from the Birmingham synchrotron, and 430 m of proton track searched for nuclear disintegrations. Disintegrations of carbon, nitrogen and oxygen were selected by the potential barrier criterion; the adequacy of this method, which depends on the presence of a short α particle track indicating the low Coulomb barrier of a disintegrating light nucleus, is discussed. The characteristics of the disintegrations occurring in the light nuclei are described and compared with those for heavy nuclei; most of the observed differences can be explained as features of the complete break-up of a nucleus consisting of a small number of nucleons. (auth)

10431

MOLECULAR BEAMS. Norman F. Ramsey. Oxford, Clarendon Press, 1956. 466p.

A detailed, consistent and up-to-date discussion on the subject of molecular beams is given. The entire subject is discussed but experiments prior to 1930 are dealt with more briefly. (F.S.)

10432

MASS DETERMINATION OF B^{10}, B^{11}, Na^{23}, K^{39}, AND K^{41} BY THE AID OF AN ELECTRON IMPACT-ION SOURCE. H. Liebl and H. Ewald. Z. Naturforsch. 11a, 406-10(1956) May. (In German)

10433

THE HALF LIFE OF Sn^{127}. H. Carminatti, I. Fraenz, R. Radicella, and J. Rodriguez (Comisión Nacional de la Energía Atómica, Buenos Aires). Z. Naturforsch. 11a, 419-20(1956) May. (In German)

10434

FORMATION OF AN ISOMERIC STATE OF THE Zn^{67} FORMED BY SLOW NEUTRON BOMBARDMENT. J. Montes Ponce de Leon and C. Sanchez del Rio (Junta de Energia Nuclear, Madrid). Anales real soc. espan. fiz. y quim. (Madrid), Ser. A 52, 137-9(1956) May-June. (In Spanish)

The identification of the isomeric state of Zn^{67} by a new method is described. Since isotopes Zn^{66} and Zn^{67} are both stable, the capture of slow neutrons by Zn^{66} sometimes leads to the formation of the isomeric state of Zn^{67}; the state is identified by its half life measured by means of delayed coincidences between the capture and the isomeric gamma rays. (auth)

10435

A NEW DETERMINATION OF THE SPECIFIC ACTIVITY OF RADIUM. Wilfrid Sebaoun. Ann. phys. (13) 1, 680-718(1956) July-Aug. (In French)

A new method is described for measuring the number of α rays emitted per second per 1 gm of Ra. A specific activity of $Z = 3.62 \times 10^{10}$ α rays/sec/gm was obtained. This value of Z corresponds to a disintegration constant $\lambda = 0.429 \times 10^{-3}$ years^{-1} and a half life of T = 1,617 years. (B.J.H.)

10436

ISOTOPIC SPIN SELECTION RULES. VII. BREAKDOWN OF THE RULES AND THE SITUATION IN ^{16}O. D. H. Wilkinson (Cavendish Lab., Cambridge, England). Phil. Mag. (8) 1, 379-92(1956) May.

Factors governing the breakdown of the isotopic spin selection rules are discussed. Two energy ranges exist within which the rules are expected to be obeyed; at low excitation, individual excited states are well separated in energy and have good isotopic spin purity so that the rules are obeyed in reactions passing through such states only; at high excitation, individual states no longer have a well-defined isotopic spin but the rules are obeyed because many overlapping levels are simultaneously excited in a total state of initially well-defined isotopic spin which breaks up before the Coulomb forces have had time to cause much isotopic spin mixing. In between these regions where the rules are obeyed (although for very different reasons), severe breakdown is to be expected. The approximate extent of these reasons is discussed. The experimental situation, as regards the operation of the rules and other consequences of charge independence, is examined in O^{16} where data concerning the effective isotopic spin purity of ten energy levels or energy ranges between 6 and 30 Mev excitation are known. Good correspondence with theoretical expectation is found in the above-described general trend of effective impurity versus excitation. It is concluded that the situation is adequately described by the Coulomb perturbation of an otherwise charge independent (symmetric) Hamiltonian. (auth)

10437

CALCULATION OF μ-MESIC ENERGY LEVELS IN HEAVY ATOMS. Sheila Brenner (Univ. Coll. of Swansea). Phil. Mag. (8) 1, 432-40(1956) May.

The μ-mesic energy levels are calculated for various nuclear charge distributions. Only the Coulomb attraction between the μ-meson and the nucleus is considered. It is found that the energy levels are almost independent of small changes in the charge distribution provided the 'radius of the distribution' (defined by the fourth moment of the distribution) is kept constant. The calculations were

done with the aid of a desk machine. The methods used are fairly simple and can easily be used with any reasonable charge distribution. (auth)

10438

DETERMINATION OF LONGTITUDINAL RELAXATION TIMES FOR MAGNETIC RESONANCE OF ATOMIC NUCLEI IN AN INTENSE HIGH-FREQUENCY MAGNETIC FIELD. S. D. Gvozdover and N. M. Ievskaia (Moscow State Univ.). Soviet Phys. JETP 2, 486-92(1956) May. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 637-44 (1955) Nov. (In Russian)

Two methods for determining the longitudinal relaxation time T_1 are treated. The methods are based on the use of the inversion of the dispersion signals observed in an intense high-frequency magnetic field during a change in the constant field and on the change in the time interval which precedes the inversion point. In order to verify the methods, an evaluation of the effect of the intermediate region which connects the resonance region and the region of free relaxation was carried out. Relationships are obtained which allow the determination of the longitudinal relaxation time. In order to confirm the methods experimentally, the dependence of the longitudinal relaxation time on the concentration of paramagnetic ions was measured in aqueous solutions of cupric sulfate and ferric nitrate. (auth)

10439

THE INTERNAL COMPTON EFFECT. A. M. Iakobson (Moscow State Teachers' Inst.). Soviet Phys. JETP 2, 751-3(1956) July. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 703-5(1955) Nov. (In Russian)

A theoretical analysis of the internal Compton effect is briefly discussed. The differential coefficient of the internal Compton effect is compared with the coefficient of internal conversion, and it is suggested that there is a simple connection between the internal Compton effect and the internal conversion process. (B.J.H.)

10440

THE SURFACE TENSION OF LIQUID He^3 IN THE REGION OF VERY LOW TEMPERATURES (1.0–0.35°K). K. N. Zinov'eva (Institute of Physical Problems, Academy of Sciences, U.S.S.R.). Soviet Phys. JETP 2, 774-5(1956) July. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 899-900(1955) Dec. (In Russian)

Measurements of the surface tension of liquid He^3 were extended to 0.35°K by the method of capillaries. Temperature and surface tension measurements are described in detail. From the resulting data, it is seen that below 0.6°K the surface tension approaches its limiting value of 0.152 dyne/cm. (B.J.H.)

10441

INDICATIVE FUNCTIONS OF SPECTRA. Jean-Louis Destouches (Institut Henri-Poincare, Paris). J. phys. radium 17, 475-9(1956) June. (In French)

A convenient procedure is indicated for representing a spectrum which is known either experimentally or theoretically. The continuous part of the spectrum is represented by the characteristic function of the complementary group. The discontinuous part of the spectrum is represented by a uniform analytic function which accepts zero spectral values. Such a function is called an " indicative function of the spectrum". This allows a classification of the spectra. For a spectrum which does not have points of accumulation, one thus obtains a complete function. For a spectrum which has accumulation points, the analytic function has singularities essential to the accumulation points. This can be explained by the intermediary of complete functions. This method is also applicable to the case of systems having quasi-stationary levels susceptible to disintegration. The real part of a zero of the indicative function gives the energy value of the level, while its imaginary part gives the radioactive constant associated with this level. (tr-auth)

10442

SHELL MODEL AND COLLECTIVE MOTION. J. Yoccoz (College de France, Paris). J. phys. radium 17, 517-18 (1956) July. (In French)

A variational method, first proposed by Hill and Wheeler, is used for the description of the collective motions of the nucleus. The results, for the relation between the moment of inertia and the deformation of the nucleus, are better than those obtained with the hydrodynamic model. (auth)

10443

EXCITED LEVELS OF DISTORTED NUCLEI. N. Marty (College de France, Paris). J. phys. radium 17, 521-5 (1956) July. (In French)

A short review of the conditions of existence and properties (energy and spin) of the excited levels due to rotational motion is given for even even nuclei and odd nuclei. The structure of particle levels in deformed nuclei and evidence of E_1 transitions are discussed. (auth)

10444

A POSSIBLE METHOD OF DETERMINING THE QUADRUPOLE MOMENT OF Cd^{111}. R. Omnes (Service de Physique Mathematique, Saclay). J. phys. radium 17, 528-9(1956) July. (In French)

It is shown that the angular correlation of polarised gamma rays in a nuclear cascade gives the sign of the quadrupole moment. (auth)

10445

L ELECTRON CAPTURE AND K FLUORESCENCE YIELD. Jeanne Laberrigue-Frolow, Pierre Radvanyi, and Michel Langevin (College de France, Paris). J. phys. radium 17, 530-1(1956) July. (In French)

A discussion is given of L/K capture ratio measurements and their dependence on the K fluorescence yield R_K. Measurements of R_K were made on Tc^{99*} and In^{115*}. A new semi-empirical curve of R_K as function of Z was calculated. With the new values of R_K the reported discrepancies between experiments and theory become smaller but still remain important. (auth)

10446

RADIOACTIVITY OF Gd^{159}. STUDY OF THE EXCITED STATES OF Tb^{159}. R. Ballini and R. Barloutaud (Service de Physique Nucléaire, Saclay). J. phys. radium 17, 534-5 (1956) July. (In French)

A γ transition of 222 kev in Tb^{159} is coincident with two transitions, probably those at 81 and 58 kev. A very weak transition of about 300 kev is also observed. The ratio of α_K coefficients of these two transitions and the relative intensities of 364, 222 and about 300 kev gammas (100-2, 5-0,5) are roughly measured. These intensities are in agreement with the calculated branching ratios (Alaga et al.) if these three transitions have the same initial state (hypothesis compatible with the measured energies). The mean life of the 364-kev state is $\leq 5 \times 10^{-10}$s. The 58-kev transition is chiefly in coincidence with a β spectrum of about 950 kev. (auth)

10447

β DISINTEGRATIONS IN THE NEIGHBORHOOD OF THE MAGIC NUMBER 14. M. E. Nahmias and T. Yuasa (College de France, Paris). J. phys. radium 17, 536(1956) July. (In French)

The anomalous behaviour of neutrons and protons in the filling up of the shells for the magic number 14 is confirmed. (auth)

10448

FAST COINCIDENCES WITH NaI(Tl) SCINTILLATORS.

MEASUREMENT OF SHORT HALF LIVES OF EXCITED STATES IN Cs^{131} AND UX_2. H. Vartapetian, L. Dick, R. Foucher, and N. Perrin (Institut du Radium). J. phys. radium 17, 537-8(1956) July. (In French).

With a slow-fast coincidence system using E. M. I. 6262 photomultiplier tubes and NaI(Tl) scintillators, it is possible to measure half lives of the order of 10^{-9} seconds for excited states. Using this method $T_{\frac{1}{2}}$ of the 122-kev level of Cs^{131} was found to be $(4 \pm 0.3) \times 10^{-9}$ sec., and $T_{\frac{1}{2}}$ of the 93-kev level of $UX_2(Pa^{234})$ was found to be $(1.8 \pm 0.3) \times 10^{-9}$ sec. (tr-auth)

10449

MEASUREMENT OF CONVERSION COEFFICIENTS BY THE METHOD OF $\gamma-\gamma$ COINCIDENCES. APPLICATIONS. N. Perrin, L. Dick, R. Foucher, and H. Vartapetian (Institut du Radium, Paris). J. phys. radium 17, 539-40(1956) July. (In French)

A correction factor to coincidence measurements of conversion coefficients is given for the case where the resolution time of the circuit is short. It is applied to the 195- and 125-kev γ rays of Rh^{102}. (auth)

10450

STUDY OF SOME γ SPECTRA OF EXCITED LEVELS OF LIGHT NUCLEI. S. Gorodetzky, Th. Muller, and M. Port (Institut de Recherches Nucléaires, Strasbourg). J. phys. radium 17, 549-50(1956) July. (In French)

A determination was made of the gamma-ray transitions of Ne^{21*} by a proton-gamma coincidence method, using the reaction Ne^{20} (d,p) Ne^{21}. The gamma-rays found were at 0.35 Mev, 1.05 Mev, 1.42 Mev and 2.78 Mev. (auth)

10451

ON THE REACTIONS $B^{10}(d,p)B^{11}$ AND $C^{13}(p,\gamma)N^{14}$. S. Gorodetzky, A. Gallmann, and M. Croissiaux (Institut de Recherches Nucléaires, Strasbourg). J. phys. radium 17, 550(1956) July. (In French)

The gamma-gamma correlation through the 6.23-Mev level of N^{14} is in agreement with spin 1 for this level. The 2.14-Mev level of B^{11} probably has spin $\frac{1}{2}$. (auth)

10452

EXCITED STATES OF He^6. Denyse Magnac-Valette and Pierre Cüer (Laboratoire de Physique Corpusculaire de Strasbourg). J. phys. radium 17, 553-4(1956) July. (In French)

An attempt was made to obtain the excited states of He^6 by the reaction $Li^7 + H^3$. Two methods were used. In one, a Li target was bombarded with 0.84-Mev tritons from ionized tritium. The resulting particles were detected by a photographic plate. In the second, a plate loaded with Li was irradiated by tritons from the reaction $Be^9(d,t)Be^8$. The ground state and excited states at 1.71 Mev and 9.3 Mev were found for He^6. There also seems to be a state in the neighborhood of 6 Mev. These results are compared to those of the Chalk River group. Effective cross sections for the formation of the ground and 1.71-Mev excited levels are given. (tr-auth)

10453

SOME REMARKS ON THE WEAKLY EXCITED LEVELS OF Be^8 AND Li^7 OBTAINED BY THE REACTIONS $Be(d,\alpha)Li^7$, $Be^9(d,t)Be^8$. J. J. Jung and Pierre Cüer (Laboratoire de Physique Corpusculaire, Strasbourg). J. phys. radium 17, 555-6(1956) July. (In French)

The detailed study of the competetive reactions $Be^9(d,\alpha)Li^7$ and $Be^9(d,t)Be^8$ gives knowledge concerning the low lying excited levels of Be^8 and Li^7 which is essential in order to ascertain the models of these nuclei. The study of these reactions are extended to 3.5 Mev with the Van de Graaff generator at Saclay. The particles emitted are collected in good geometry in nuclear emulsions after magnetic separation. A histogram of 8,000 triton tracks at 30° indicates very clearly the well known broad 2.8-Mev state of Be^8. The end of the continuum shows the α + t transitions for the narrow 4.6-Mev state and the wide 6.6-Mev state of Li^7. No other state was found for Li^7. A significant peak at 2.2-Mev for Be^8 merits further study. (tr-auth)

10454

THE REACTION $B^{10}(d,\alpha)Be^8$. C. Bockelman and A. Leveque (Massachusetts Inst. of Tech., Cambridge and Physique Nucléaire, Saclay). J. phys. radium 17, 557 (1956) July. (In French)

The excited states of Be^8 in the excitation region between 0 and 9 Mev have been studied using the M. I. T. broad range heavy partice spectrograph. The reaction $B^{10}(d,\alpha)Be^8$ has been used, the bombarding energy being 5 Mev. No level has been found excepting well established state at 2.94 Mev. (auth)

10455

SECOND EXCITED STATE OF F^{19}. HALF LIFE AND MAGNETIC MOMENT. P. Lehmann, A. Leveque, M. Fiehrer, and R. Pick (Physique Nucléaire, Saclay). J. phys. radium 17, 560(1956) July. (In French)

The variation of the angular distribution of the 197-kev gamma ray of F^{19*} with respect to the direction of the proton beam is measured as a function of a magnetic field acting on the nuclei. The target of F^{19} is in a liquid state (FK in H_2O) to decrease the quadrupole interaction. The value found for μ(197 kev) is + 3.7 ± 0.4. No significant quadrupole perturbation is found. (auth)

10456

THE FIRST LEVELS OF F^{18}. V. Naggiar, M. Roclawski-Conjeaud, D. Szteinsznaider, and J. Thirion (Service de Physique Nucléaire, Saclay). J. phys. radium 17, 561 (1956) July. (In French)

The analysis of neutrons and gammas from the reaction $O^{18}(p,n)F^{18*}$ confirms an already known (1,050 ± 20)-kev level for F^{18}. A (950 ± 15)-kev level is revealed. (auth)

10457

EFFECTIVE CROSS SECTION OF THE RADIATIVE CAPTURE OF U^{236}. J. Charon, P. Hubert, and R. Joly (Neutronique Experimentale, Saclay). J. phys. radium 17, 564(1956) July. (In French)

The radiative capture cross section of U^{236} was re-examined and the value found is a confirmation of the first measurement (24 ± 7 b) in disagreement with the value (9 ± 2 b) reported in AECU-2040 for pile neutrons. This discrepancy is tentatively attributed to the effect of the resonances. (auth)

10458

$\alpha-\gamma$ SPECTROMETRY. SOME MEASUREMENTS ON Pa^{231}, RAc. R. Foucher, L. Dick, N. Perrin, and H. Vartapetian (Institut du Radium, Paris). J. phys. radium 17, 581-2 (1956) July. (In French)

Verification by $\alpha-\gamma$ coincidence spectrometry was made of the period of the 27-kev transition in $P^{231} \rightarrow Ac^{227}$. The close study of the delayed coincidence curve makes it possible to attribute this period to the 27-kev level (E_1 transition). The same study applied to the 50-kev γ gives a superior limit of 2×10^{-9} sec. for the period of this E_1 transition. (auth)

10459

MEASUREMENT OF THE HALF LIFE OF RADON (Rn^{222}) BY CALORIMETRY. J. Robert. J. phys. radium 17, 605(1956) July. (In French)

The advantages of the calorimetric method of determining half lives are briefly surveyed. The value of $T_{\frac{1}{2}}$ for Rn^{222} using this method was found to be 3.825 ± 0.004 days. This value is in good agreement with values obtained by other methods. (B.J.H.)

10460

STABILISATION AGENTS IN WELL COUNTING FOR REPRODUCIBLE ASSAY OF RADIOACTIVE COLLOIDS. L. E. Preuss and A. Vann (Edsel B. Ford Inst. for Medical Research, Detroit). Atomics 7, 260-1(1956) July.

A method is described in which certain conventional suspension media are used to stabilize colloidal Au^{198} specimens for liquid sample well scintillation counting. The technique applies some suspension methods to the systems of radiation detection. The method is rapid, bypasses lengthy digestions, and eliminates sedimentation errors encountered in the well crystal technique. Such sedimentation errors are briefly discussed. (auth)

10461

STOPPING CROSS SECTION OF SOLIDS FOR PROTONS, 50-600 KEV. M. Bader, R. E. Pixley, F. S. Mozer, and W. Whaling (California Inst. of Tech., Pasadena). Phys. Rev. 103, 32-8(1956) July 1.

The stopping cross sections of Li, Cu, LiF, CaF_2, Pb, and Au for protons have been measured over the energy range E_p = 50 to 600 kev; the stopping cross section of Be for protons has been measured for E_p = 50 to 2600 kev. An electrostatic analyzer and magnetic spectrometer were used to measure the energy loss of protons in a thin film of the stopping material. The density of the stopping film was determined by weighing, or by quantitative chemical analysis of, a known area. The ratio of the stopping cross section of Al, Cu, Mn, Ta, and Pb to that of Au was measured by observing the yield of elastically scattered protons from these targets for E_p = 200 to 600 kev. The ratio of stopping cross section of Ca, V, Cr, Mn, Fe, Co, Ni, Cu, and Zn, to that of Mn was measured for E_p = 200 to 600 kev by the same method. In the region Z = 23 to 29, the stopping cross section decreases as the atomic number of the stopping material increases. The probable error of absolute stopping cross section measurements in this experiment is 3%. (auth)

10462

SCATTERING OF ELECTRONS FROM CLUSTERED VACANCIES IN COPPER. D. L. Dexter (Univ. of Rochester, N. Y.). Phys. Rev. 103, 107-10(1956) July 1.

The excess resistivity, ρ, and resistivity per unit stored energy, q, associated with dislocations, vacancies, and interstitials are briefly reviewed, and the same quantities are calculated for clustered vacancies. For clusters of more than one hundred vacancies, which seem to exist at room temperature in cold-worked or bombarded copper, q is larger by factors of about 3,8, and several hundred than the corresponding ratios for vacancies, interstitials, and dislocations. (auth)

10463

GROUND-STATE SOLUTION OF THE NONRELATIVISTIC EQUATION FOR HELIUM. H. M. Schwartz (Univ. of Arkansas, Fayetteville). Phys. Rev. 103, 110-11(1956) July 1.

By the inclusion of half-integral powers in the Hylleraas functions for the ground state of the helium atom, it is possible to obtain more rapid convergence in the Ritz variational method applied to the nonrelativistic Schrödinger equation (for infinite nuclear mass), as shown by results of calculations involving from four to thirteen parameters. The energy obtained with 13 parameters, −2.903719 a.u., is the lowest so far published. The coefficients for the normalized wave functions are given. (auth)

10464

LOWER BOUND TO THE GROUND-STATE ENERGY AND MASS POLARIZATION IN HELIUM-LIKE ATOMS. Lawrence Wilets and Ivan J. Cherry (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 103, 112-15(1956) July 1.

Using a method which involves finding the expectation value of the square of the Hamiltonian, lower bounds to the ground state energies of He, Li^+, and O^{6+} have been obtained from existing Hylleraas-type wave functions. The limit of error in the Chandrasekhar-Herzberg 18-parameter helium upper bound, −2.9037063 atomic units (a.u.), is found to be in absolute value less than 0.00179 a.u. and "probably" less than 0.00009 a.u. (~ 20 cm^{-1}). These results would seem to indicate that the Hylleraas series is not as rapidly convergent as previously thought. Again using existing Hylleraas-type wave functions, values have been obtained for the mass polarization (specific mass effect) in the same helium-like atoms. The value obtained for helium is somewhat different from that given by Bethe. (auth)

10465

INFLUENCE OF THE TIME-DEPENDENT QUADRUPOLE INTERACTION ON THE DIRECTIONAL CORRELATION OF THE Cd^{111} GAMMA RAYS. R. M. Steffen (Purdue Univ., Lafayette, Ind.). Phys. Rev. 103, 116-25(1956) July 1.

The influence of the time-dependent quadrupole interaction in various liquid sources of In^{111} on the directional correlation of the Cd^{111} gamma rays has been investigated quantitatively. By using the technique of delayed correlation measurements, the characteristic interaction (relaxation) parameters λ_2 have been determined for aqueous $InCl_3$ solutions as a function of the macroscopic viscosity. These experiments revealed that λ_2 is not simply proportional to the macroscopic viscosity of the liquid as might be expected from simple considerations. The extranuclear interaction in indium metal sources was studied as a function of temperature. The realtively large attenuation of the Cd^{111} gamma-gamma correlation in polycrystalline indium metal was found to vanish completely upon reaching the liquid phase, a result which was confirmed by delayed correlation measurements. The "true," unperturbed, directional correlation of the Cd^{111} gamma rays was computed from these experimental data and is represented by $W(\Theta) = 1 - (0.180 \pm 0.002)P_2(\cos\Theta) + (0.002 \pm 0.003)P_4(\cos\Theta)$. This correlation is characteristic for a cascade of a mixed M1 + E2 transition, with an E2/M1 intensity ratio of $0.021 \pm 0.002 (\delta = +0.146)$ followed by a pure E2 transition, between states of angular momentum quantum number 7/2, 5/2, and 1/2. (auth)

10466

MAGNETIC MOMENT OF THE 247-KEV EXCITED STATE OF Cd^{111}. R. M. Steffen and W. Zobel (Purdue Univ., Lafayette, Ind.). Phys. Rev. 103, 126-33(1956) July 1. (cf. NSA 9-3282).

The magnetic moment of the 247-kev (I = 5/2) excited state state of Cd^{111} was determined from the effects of an external magnetic field on the directional correlation of the Cd^{111} gamma rays. Two methods of measurement were employed. The observation of the attenuation of the directional correlation yielded for the magnetic moment $|\mu_{5/2}|$ = (0.80 ± 0.04) nm, taking into account the time-dependent quadrupole interaction in the liquid sources which were used for this measurement. The more accurate method of determining the azimuthal shift of the correlation pattern about the axis of the magnetic field gave a more precise value of the magnetic moment, $\mu_{5/2} = -(0.783 \pm 0.023)$ nm. (auth)

10467

INELASTIC SCATTERING OF PROTONS FROM Cl^{35} AND Cl^{37}. J. P. Schiffer, C. R. Gossett, G. C. Phillips, and T. E. Young (Rice Inst., Houston, Tex.). Phys. Rev. 103, 134-5(1956) July 1.

The Rice Institute 180°-magnetic spectrometer was used in measuring the energies of inealstically scattered protons from targets of normal KCl and from NaCl targets enriched in Cl^{35} and Cl^{37}. Bombarding energies of 4.6, 4.7, 4.8, 5.0,

and 5.6 Mev were used. One state of 1.713 ± 0.010 Mev was observed in Cl^{37} and two states at 1.220 ± 0.005 and 1.766 ± 0.005 Mev are assigned to Cl^{35} for energies of excitation below 2 Mev. No state below 2.0-Mev excitation was observed in K^{39}, while the first excited state of Na^{23} was determined as 437 ± 5 kev. (auth)

10468

SPIN OF N^{16}. B. J. Toppel (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 103, 141-2(1956) July 1.

Observations have been made on the intensity ratio of the 6.13- to 7.11-Mev gamma rays of O^{16} following decay of N^{16} in order to test the possibility that the ground and first excited states of N^{16} have spin 0− and 3− as preliminary results of recent calculations by Elliott have predicted. The ratio was obtained with N^{16} made by the $O^{16}(n,p)N^{16}$ reaction and by the $F^{19}(n,\alpha)N^{16}$ reaction. For the first reaction, the ratio was obtained for two ages of the N^{16}. The constancy of the resulting intensity ratios implies that the theoretical prediction is not correct. (auth)

10469

ATOMIC MASSES OF Ni^{58} AND Ni^{60}. Philip C. Eastman, Neil R. Isenor, G. Ronald Bainbridge, and Henry E. Duckworth (McMaster Univ., Hamilton, Ont., Canada). Phys. Rev. 103, 145-6(1956) July 1.

Mass spectrographic measurements are reported of the mass differences $C_2H_4O_2-Ni^{60}$ and $C_3H_6O-Ni^{58}$. These results are used, together with existing data, to discuss certain discrepancies between transmutation and mass spectroscopically determined masses in the Fe−Ni−Zn section of the atomic mass table. (auth)

10470

NEW ISOTOPES: Er^{172} AND Tm^{172}. D. R. Nethaway and M. C. Michel (Univ. of California Radiation Lab., Berkeley) and W. E. Nervik (Univ. of California Radiation Lab., Livermore). Phys. Rev. 103, 147-8(1956) July 1.

Two new isotopes, Er^{172} of half life 49.8 ± 1 hr, and Tm^{172} of half life 63.6 ± 0.3 hr, have been found. The mass assignment of Tm^{172} was proven by direct mass separation, and that of Er^{172} by genetic relationship. The Tm^{172} isotope was found to emit a 1.5-Mev β^- particle, γ rays of 1.79, 1.44, 1.09, 0.40, 0.18, and 0.076 Mev, and a K x ray of 0.049 Mev. The mass assignments of Er^{165}, Er^{171}, and Tm^{171} were verified. (auth)

10471

RADIOACTIVE DECAY OF Yb^{177}. J. P. Mize, M. E. Bunker, and J. W. Starner (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 103, 182-5(1956) July 1.

The decay characteristics of the 1.8-hr negatron emitter Yb^{177} have been investigated by means of beta-ray and gamma-ray coincidence scintillation spectrometers. Gamma rays of energies 0.118, 0.140, 0.147, 0.95, 1.09, 1.12, and 1.24 Mev are found to accompany the decay. The gamma-ray energy and intensity data can be satisfied by postulating excited levels in Lu^{177} at 0.118, 0.147, 0.287, and 1.24 Mev. Beta-gamma coincidence scintillation spectrometer studies indicate that the 0.118-, 0.147-, and 1.24-Mev levels as well as the ground state of Lu^{177} are directly populated by beta decay from Yb^{177}. Tentative spin and parity assignments for the excited levels of Lu^{177} are presented. (auth)

10472

INTERACTION OF 10-MEV PROTONS WITH BERYLLIUM. Stanley W. Rasmussen (Univ. of Minnesota, Minneapolis). Phys. Rev. 103, 186-9(1956) July 1.

Differential elastic and inelastic scattering cross sections were measured for 10-Mev protons on Be, using a nuclear-emulsion technique. The Minnesota linear proton accelerator was used to provide a well-collimated monoenergetic beam. The results for elastic scattering are compared with other experiments, on the basis of a simple optical model, showing that, although the variation of elastic scattering cross section with angle is similar to that of other light elements, there are quantitative differences. The results on inelastic scattering are shown to be consistent with the currently accepted odd parity, J = 3/2 or 5/2, for the 2.4-Mev state of Be^9. It appears, however, that a complex model of the Be^9 nucleus will be required to explain the results in detail. The (p,d) reaction cross section for Be^9 is also mentioned briefly. (auth)

10473

DIRECT EXCITATION OF NUCLEAR ENERGY STATES IN CARBON BY 96-MEV PROTONS. K. Strauch and F. Titus (Harvard Univ., Cambridge, Mass.). Phys. Rev. 103, 200-8(1956) July 1.

The scattering of 96-Mev protons from a carbon target has been investigated at laboratory angles between 3° and 90°. At the larger scattering angles, besides the elastic peak and inelastic continuum, inelastic peaks are found whose magnitude compares with the elastic peak. These inelastic proton peaks correspond to an excitation energy of the target nucleus of 4.4, 9.6, and 20.8 Mev. The angular distribution of elastically scattered protons shows slight diffraction minima at 40° and 64° (center-of-mass) after a careful separation of elastic from inelastic protons is made. The inelastic protons are peaked in the forward direction. Possible interaction models are discussed. (auth)

10474

PHASE SEPARATION IN He^3-He^4 SOLUTIONS. G. K. Walters and W. M. Fairbank (Duke Univ., Durham, N. C.). Phys. Rev. 103, 262-3(1956) July 1.

Nuclear magnetic resonance techniques were used to detect a separation of He^3-He^4 solutions into two distinct liquid phases at temperatures below 0.8°K. An approximate phase diagram for the solutions is shown. (B.J.H.)

10475

NUCLEAR RESONANCE EXPERIMENTS ON PURE He^3 UNDER PRESSURE. G. K. Walters and W. M. Fairbank (Duke Univ., Durham, N. C.). Phys. Rev. 103, 263-4(1956) July 1.

Nuclear magnetic resonance techniques were used to study the density of He^3 at 1.2°K as a function of pressure and the nuclear susceptibility of He^3 as a function of pressure between 0.2 and 1.2°K. Results of the density measurements are tabulated. (B.J.H.)

10476

ALPHA AND SPONTANEOUS FISSION HALF-LIVES OF PLUTONIUM-242. J. F. Mech, H. Diamond, M. H. Studier, P. R. Fields, A. Hirsch, C. M. Stevens, R. F. Barnes, D. J. Henderson, and J. R. Huizenga (Argonne National Lab., Lemont, Ill.). Phys. Rev. 103, 340-1(1956) July 15.

Measurements on Pu^{242} samples, highly enriched by neutron irradiation, resulted in the alpha half-life value of $(3.88 \pm 0.10) \times 10^5$ years and in the spontaneous fission half-life value of $(7.06 \pm 0.19) \times 10^{10}$ years. (auth)

10477

GAMMA TRANSITIONS IN Ta^{181}. F. Boehm and P. Marmier (California Inst. of Tech., Pasadena). Phys. Rev. 103, 342-3(1956) July 15.

The nuclear spectrum of Ta^{181} has been investigated. The excited levels have energies of 136.25, 482.0, 615.0, 618.9, and 958.0 kev. The gamma-ray energies are 3.9, 133.02, 136.25, 136.86, 345.85, 476.0, 482.0, and 615.5 kev. Multipolarities for the gamma rays are given and spin assignments to the levels are proposed. (auth)

10478

α-PARTICLE MODEL OF O^{16}. S. L. Kamey (California Inst. of Tech., Pasadena). Phys. Rev. 103, 358-64(1956) July 15.

Lifetimes of the four lowest excited states of O^{16} were calculated on the α-particle model and are here compared with experimentally observed values. In addition, the computation of energy levels on each of the two possible level identification schemes has been extended to include all predicted energy levels up to 16 Mev, and compared with the current experimental data. Lastly, the α-particle model was used to provide the core wave function of a partially-excited-core shell model of O^{17}, and the lifetime of the $\frac{1}{2}^+$ 870-kev state of O^{17} and the electric quadrupole and magnetic moments of the ground state were computed and are compared with experimental values. The energy level predictions on one identification scheme are in excellent agreement with experimental values in the 0 to 12.95-Mev range, in that of nineteen observed excited levels, fifteen can be matched within 1.1 Mev and three others tentatively matched (depending upon experimental determination of spins and parities); while two levels are predicted but not observed. The lifetime calculations agree to within factors of 15 with experimental values, except for an electric dipole transition which is forbidden on the model. The O^{17} calculations are useful only in evaluating one of the lifetime calculations. (auth)

10479

ELECTRON DOUBLE SCATTERING BY NUCLEAR MAGNETIC MOMENTS. Roger G. Newton (Indiana Univ., Bloomington). Phys. Rev. 103, 385-9(1956) July 15.

Polarization effects in the scattering of high-energy electrons by charges and magnetic moments are discussed. A double scattering experiment using targets with lined-up nuclear spins should be a sensitive means of obtaining information about a possible difference in the charge and magnetic moment distributions of nuclei. (auth)

10480

LOWEST ODD-PARITY STATES IN EVEN-EVEN NUCLEI. H. Morinaga (Univ. of Lund, Sweden). Phys. Rev. 103, 503-4(1956) July 15.

In order to investigate the possibility of a general trend in odd-parity states in even-even nuclei, the lowest experimentally identified odd-parity states were compiled and their energies plotted against A. Results indicate that the states have odd angular momentum; appear not too far from the line $E = 67A^{-\frac{1}{3}}$ Mev; appear in groups around O, Ca, Sr, etc.; core effects are pronounced for heavy elements; and, points in light nuclei fall fairly well on the line. (B.J.H.)

10481

RADIOACTIVE ISOTOPES Cl^{40} AND Ga^{74}. H. Morinaga (Purdue Univ., Lafayette, Ind.). Phys. Rev. 103, 504-5 (1956) July 15.

In a search for further odd-parity states in even-even nuclei, two previously unknown isotopes Cl^{40} and Ga^{74} were made and investigated. The Cl^{40} and Ga^{74} were produced by neutron bombardment of A and Ge respectively. Proposed decay schemes are presented. (B.J.H.)

10482

NEUTRON DIFFRACTION STUDIES ON IRON AT HIGH TEMPERATURES. M. K. Wilkinson and C. G. Shull (Oak Ridge National Lab., Tenn.). Phys. Rev. 103, 516-24(1956) Aug. 1.

Neutron diffraction measurements have been made on iron at a series of elevated temperatures up to about 1000°C to establish the magnetic scattering effects through the Curie temperature and in the γ-phase region. Diffraction patterns obtained for the face-centered-cubic γ phase offer no evidence for an antiferromagnetic structure in γ iron at high temperatures, and the diffuse scattering above T_C suggests that both phases of the metallic lattice are paramagnetic in that temperature region. At temperatures up to the α-γ phase transformation, the paramagnetic scattering suggests the existence of considerable ferromagnetic short range order. Pronounced small-angle scattering was found to develop in the temperature region around the Curie transition, and this type of scattering is explained on the basis of the critical magnetic scattering suggested by Van Hove. Detailed investigations, which included experiments on nickel and magnetite near their Curie transitions, were performed to determine the general characteristics of the critical magnetic scattering. (auth)

10483

CRITICAL MAGNETIC SCATTERING OF NEUTRONS BY IRON. H. A. Gersch (Georgia Inst. of Tech., Atlanta) and C. G. Shull and M. K. Wilkinson (Oak Ridge National Lab., Tenn.). Phys. Rev. 103, 525-34(1956) Aug. 1.

The experimental results of Wilkinson and Shull for the small-angle magnetic scattering of 0.9 A neutrons from iron at temperatures close to the Curie point are analyzed in terms of the instantaneous correlation between pairs of spins of the iron atoms. Fourier inversion of the angular distribution of the scattering gives the spatial dependence of the spin-spin correlations, while their temperature dependence follows from the temperature variation of the angular distributions. The correlation functions so obtained are compared with the asymptotic form predicted by statistical mechanics and show consistency with the measured values of the paramagnetic susceptibility for iron above the Curie temperature. (auth)

10484

HALF-LIVES AND NEUTRON CAPTURE CROSS SECTIONS OF THE HEAVY PLUTONIUM ISOTOPES. J. P. Butler and T. A. Eastwood (Atomic Energy of Canada, Ltd., Chalk River, Ont.) and T. L. Collins, M. E. Jones, F. M. Rourke, and R. P. Schuman (Knolls Atomic Power Lab., Schenectady, N. Y.). Phys. Rev. 103, 634-7(1956) Aug. 1.

Specific alpha activities have been obtained for Pu^{240} and Pu^{242} corresponding to half-lives of 6600 ± 100 years and 379,000 ± 5000 years, respectively. A half-life of $(7.5 \pm 2) \times 10^7$ years has been obtained for Pu^{244} by separating uranium daughters. The irradiation of a sample of Pu containing Pu^{244} gave a neutron capture cross section of 2.1 ± 0.3 barns for Pu^{244} and yielded 10.6 ± 0.4 hr Pu^{245} and its 124 ± 1 min Am^{245} daughter. (auth)

10485

EXCITED STATES OF S^{34}. G. S. Stanford and G. F. Pieper (Yale Univ., New Haven, Conn.). Phys. Rev. 103, 637-42 (1956) Aug. 1.

The mode of decay of the second excited state of S^{34} has been examined, using a "slow-fast" coincidence technique to examine the gamma rays in coincidence with the appropriate proton group from the reaction $P^{31}(\alpha,p)S^{34}$. By comparing the observed cascade to cross-over intensity ratio with that calculated from the Weisskopf lifetime relationships, the number of possible spin-parity combinations for the first and second excited states can be restricted. When the results of beta decay studies are taken into account, it can be inferred that the first two excited states of S^{34} are both 2+. Spin 0+ for the ground state is assumed. New measurements of the energies of the low-lying excited states of S^{34} are reported. It is concluded that there are levels at 2.13 ± 0.02, 3.33 ± 0.05, 4.32 ± 0.08, and 4.8 ± 0.1 Mev. (auth)

10486

FIRST EXCITED STATES IN Zr^{92} AND Zr^{94}. G. L. Griffith (Westinghouse Research Labs., Pittsburgh). Phys. Rev. 103, 643-5(1956) Aug. 1.

Fast neutron inelastic scattering by separated isotopes of Zr was studied by observing the de-excitation gamma-ray spectra. The (926 ± 9)-kev photopeak observed with normal

Zr scatterers was shown to be produced by two gamma rays differing in energy by less than 2.5% and originating in the isotopes Zr^{92} and Zr^{94}. This is interpreted as evidence for a first excited state at about 926 kev in both isotopes. Relative excitation curves for gamma-ray production by neutron inelastic scattering have been measured from threshold to E_n = 5.5 Mev for the 850-kev gamma ray from Fe^{56} and the 926-kev gamma rays from Zr^{92+94}. (auth)

10487

ANGULAR CORRELATIONS IN Ti^{48}. C. F. Coleman (Atomic Energy Research Establishment, Harwell, Berks, England). Phys. Rev. 103, 647-51(1956) Aug. 1.

The angular correlations of the (0.99, 1.32) Mev and (2.23, 0.99) Mev gamma-ray cascades in Ti^{48} have been measured and are consistent with spin assignments to the ground, 0.99-, 2.31-, and 3.22-Mev states of 0, 2, 4, and 6, respectively. Taken with these results, the measured values of the two polarization-direction correlations for the (0.99, 1.32) Mev cascade rule out most spin assignments for the first three levels which require a mixed 1.32-Mev transition, and show that these levels must all have even parity. The mean lifetime of the 0.99-Mev level was found to be $<2 \times 10^{-11}$ sec. (auth)

10488

Q-VALUE MEASUREMENTS FOR PHOSPHORUS AND CHLORINE. D. M. Van Patter, C. P. Swann, W. C. Porter, and C. E. Mandeville (Bartol Research Foundation of the Franklin Inst., Swarthmore, Penna.). Phys. Rev. 103, 656-61(1956) Aug. 1.

Targets containing P and Cl were bombarded by protons. Charged particles from nuclear reactions were analyzed at 90° by using a 180° double-focusing magnetic spectrometer. The following ground-state Q values have been determined: $P^{31}(p,\alpha)Si^{28}$, Q = 1.911 ± 0.005 Mev; $Cl^{35}(p,\alpha)S^{32}$, Q = 1.851 ± 0.007 Mev; $Cl^{37}(p,\alpha)S^{34}$, Q = 3.015 ± 0.011 Mev. The following level positions have been measured: P^{31}, 1.264 ± 0.004 Mev; S^{34}, 2.129 ± 0.014 Mev; Cl^{35}, 1.219 ± 0.005 Mev. At E_p = 3.055 Mev, a survey was made for inelastic proton groups from P^{31} corresponding to levels from 0 to 1.43-Mev excitation. Only one group (Q = −1.264 Mev) was observed; no other groups were observed with an intensity greater than 15% of the intensity of this group. (auth)

10489

EXCITED STATES IN B^{10}. Jerry B. Marion (California Inst. of Tech., Pasadena). Phys. Rev. 103, 713-17(1956) Aug. 1.

Energy levels in B^{10} have been investigated by observing the neutrons from the $Be^9(p,n)B^9$ reaction and the γ rays from the $Be^9(p,\alpha\gamma)Li^6$ reaction in the range of bombarding energy from 2 Mev to 5 Mev. At E_p = 2.562 ± 0.006 Mev both the neutrons and the γ rays are resonant. The width of the γ-ray peak is 38 ± 3 kev while the width of the neutron peak is 85 ± 10 kev. The results are analyzed in terms of two B^{10} states at 8.89 Mev which probably are the analogs to the 7.37- and 7.54-Mev states in Be^{10}. The neutron reduced widths for the B^{10} states are in good agreement with those for the Be^{10} states if the neutron and γ-ray resonances have $J = 3^+$, $T = 1$ and $J = 2^+$, $T = 1$, respectively. In addition, a broad resonance in the neutron yield at $\theta = 90°$ near 3.2 Mev indicates a wide level ($\Gamma \approx 0.7$ Mev) in B^{10} at 9.5 Mev. Angular distributions of the neutrons have been measured and total cross sections obtained at bombarding energies of 2.56, 2.92, 3.06, 3.56, and 4.56 Mev. (auth)

10490

MAGNETIC MOMENT OF THE SECOND EXCITED STATE OF F^{19}. Kenzo Sugimoto and Akira Mizobuchi (Osaka Univ., Japan). Phys. Rev. 103, 739-40(1956) Aug. 1.

The magnetic moment of the second excited state (200 kev) of F^{19} was deduced from the change, caused by a magnetic field, in the angular distribution of the de-excitation radiation following (p,p') by F^{19}. The Larmor precession of the excited nucleus displayed in the angular distribution and the rotational change of the angular distribution was measured as a function of the magnetic field strength. If one disregards the influences of the surrounding atoms, the apparent value of the magnetic moment was deduced as $\mu(F^{19*}, 5/2^+) = +(3.0 \pm 0.7)\mu_N$. If one considers these effects, the value obtained gives a lower limit. (auth)

10491

$Li^6(n,\alpha)H^3$ CROSS SECTION AS A FUNCTION OF NEUTRON ENERGY. F. L. Ribe (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 103, 741-8(1956) Aug. 1.

The total $Li^6(n,\alpha)H^3$ cross section has been measured absolutely over the range of neutron energies from 0.88 to 14.1 Mev, with errors varying from 11 to 18%. At its low-energy end, the curve $\sigma(E_n)$ joins smoothly with an extension of the curve of earlier data of Blair and Holland, for which the maximum neutron energy was 0.62 Mev. A log-log plot of $\sigma(E_n)$ for the present data shows a variation approximately as E_n^{-1} for the high-energy portion of the curve with a break to greater flatness at the lower energies, resulting in a broad hump in the cross-section curve at about 2 Mev. This hump is believed to be due to competition from deuteron-producing reactions. (auth)

10492

THREE-MILLIMICROSECOND METASTABLE STATE IN Pb^{209}. D. Strominger, F. S. Stephens, Jr., and J. O. Rasmussen (Univ. of California, Berkeley). Phys. Rev. 103, 748-50(1956) Aug. 1.

Coincidence studies of radioactive isotopes in the Ac^{225} decay chain were made. A metastable state of Pb^{209} with a half-life of (3.1 ± 1.0) mμ sec was observed. This delay following beta decay of Tl^{209} to Pb^{209} is exhibited by a 120-kev E1 gamma transition and other gamma transitions succeeding the 120-kev gamma transition. Upper limits are set for the lifetimes of several other gamma transitions present in the Ac^{225} chain. An explanation for the delayed nature of this 120-kev E1 transition is given in terms of parentage overlap. Some unusual features of the beta decay rates of Tl^{209} to Pb^{209} are discussed. (auth)

10493

GAMMA-RAY BRANCHING RATIO OF THE 3.95-MEV LEVEL IN N^{14}. H. E. Gove, A. E. Litherland, E. Almqvist, and D. A. Bromley (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Rev. 103, 835-7(1956) Aug. 1.

Proton and gamma spectra from the $C^{12}(He^3,p)N^{14}$ reaction using 1.55-Mev He^3 are given. (D.E.B.)

NUCLEAR REACTORS

10494 AERE-C/M-278

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

MATHEMATICS OF FISSION PRODUCT FORMATION IN REACTORS WITH CIRCULATING FUEL. C. J. L. Lock. May 1956. 18p.

In reactors with circulating fuel the fuel is exposed to intermittent radiation. Formulae are presented enabling the calculation of the amount of any fission product after any time of reactor operation under varying conditions. Formulae are also presented to enable calculation of the amount of fission product gases present in the reactor assuming various efficiencies of removal. (auth)

10495 AERE-E/M-31

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

VISCOSITY-PLATES FLOW AND LOADING. J. Woodrow. Dec. 22, 1949. 6p.

The radially inward flow between annular viscosity plates

is investigated by the methods of lubrication theory. The flow rates and pressure distributions are obtained for isothermal flow of a gas and for an incompressible fluid. The resultant force on the plates due to the radial flow are worked out for the same two cases. If the entry pressure equals the pressure outside the plates, the load can be expressed in a completely non-dimensional form, involving only the shape factor q, and the pressure ratio s. For an incompressible fluid, the load factor depends only on the shape factor q. (auth)

10496 AERE-E/M-72

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

STEADY STATE TEMPERATURE DISTRIBUTIONS IN A TYPE OF REACTOR CHANNEL WITH REVERSAL OF COOLANT FLOW. D. V. Wordsworth. June 22, 1953. 14p.

Expressions were found for the coolant and U steady state temperature distributions for a certain type of reactor channel in which the coolant enters and leaves at the same end. The coolant is carried from the entry end to the opposite end in a central duct along the channel axis; it is then allowed to reverse, divide, and flow back on either side of an annular U rod to the common entry and exit end. Two cases have been considered in which the neutron flux distribution follows a cosine law or is uniform along the channel length. One example was worked out for a cosine flux distribution. The exit temperatures of the two coolants were found to differ by 78° and it was found that about half the total temperature rise was achieved in the central duct. At the common entry-exit end, the effect of the comparatively low entry temperature was predominant, and all heat there is being transferred to the coolant, resulting in a slug temperature below the outer coolant temperature. (auth)

10497 AERE-E/R-388

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

TEMPERATURE OF AIR COOLED PILE IN INITIAL STAGES OF DIVERGENCE. J. Woodrow. Aug. 10, 1949. 9p.

An approximate method of determining the temperature response of a pile to a given heat output is developed and applied to the Harwell Pile, assuming exponential divergence. The additional thermal lag if a thermocouple is used to indicate pile temperatures is also investigated. (auth)

10498 AERE-ED/R-1590

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

XENON POISONING TRANSIENTS FOLLOWING CHANGES IN REACTOR POWER, AND THEIR EFFECT ON REACTIVITY. W. MacRae and R. Parr. Jan. 19, 1954. 22p.

The effect of Xe poison on the reactivity of thermal reactors, during the transient conditions which obtain subsequent to a step change in flux is considered. Curves are included which permit the initial equilibrium reactivity absorbed, the initial rate of change of reactivity absorbed, the initial rate of change of reactivity, the maximum value, and the time to reach the maximum value, to be quickly assessed. (auth)

10499 AERE-M/R-1950

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

ESTIMATED CONCENTRATIONS OF THE HEAVY ELEMENTS IN A LIQUID METAL FUELLED REACTOR WITH CONTINUOUS CHEMICAL PROCESSING. W. H. L. Porter. June 1956. 49p.

Tables and charts are presented giving the concentrations of the heavy isotopes in the blanket and core of a homogeneous reactor system with particular reference to a U–Th–Bi liquid metal fueled reactor. The processing rates for transfer of fissile material from the blanket to the core are established for steady state operation. The build-up of non-fissile U and fission products on start-up is also discussed. (auth)

10500 AERE-R/M-3

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England].

THE EXCESS REACTIVITY CONTROLLED BY A SINGLE, CENTRAL CONTROL ROD. J. D. McCullen. [nd] 5p.

The excess reactivity which can be controlled as the diameter of a single, central control rod is varied, is investigated for a small reactor with graphite moderator. The results are presented graphically for a range of diameters from 0.4 to 12.0 inches. (auth)

10501 AERE-R/M-6

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

BERYLLIA MODERATED SYSTEMS. J. D. McCullen. Apr. 16, 1951. 6p.

Results are given of lattice calculations for natural U–BeO moderated systems with a graphite reflector. (auth)

10502 AERE-RP/M-81

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE APPROACH TO CRITICALITY OF ZEUS. K. C. Hines and J. Egerton. May 1956. 12p.

The loading of Zeus was carried out in the following way: an outer ring of fuel elements was inserted first, then loading was commenced at the centre, fuel elements being added in such a way as to close up the gap between the inner cylindrical region of fuel and the outer annular region. The problem of loading a reactor in this way is considered theoretically on the basis of one-group theory. For a series of values of the radius, "a," of the central fuel cylinder the appropriate eigenvalue of the system is found and from this the flux just outside the core of the reactor is calculated. These flux values as functions of "a" are plotted and compared with the experimentally determined results. (auth)

10503 AERE-T/M-48

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

PRELIMINARY ESTIMATE OF THE CRITICAL RADIUS OF A BARE Pu–Be INTERMEDIATE REACTOR WITH Pb COOLANT. M. E. Mandl. June 8, 1951. 12p.

10504 AERE-T/M-59

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

PRELIMINARY ESTIMATE OF THE CRITICAL RADIUS OF A Pu–Be INTERMEDIATE REACTOR WITH AN INFINITE REFLECTOR, WITH AND WITHOUT Pb COOLANT. M. E. Mandl. Feb. 1952. 10p.

10505 AERE-T/M-65

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EFFECT OF Na COOLING ON A BARE U^{235}–Be UNDERMODERATED THERMAL REACTOR. M. E. Mandl. Aug. 1952. 17p.

For one core composition of a bare homogeneous U^{235}–Be intermediate reactor, the effect of adding one given proportion of Na upon the critical radius has been calculated. Comparing the result with the critical radius and median energy of the uncooled reactor suggests that the slowing down in the Na produces almost negligible effect upon the energy spectrum and that the change in critical radius is entirely due to the volume effect upon the

slowing-down length. Assuming that this represents the effect of Na cooling, graphs of critical radii and weights of U^{235} required for various amounts of Na present were prepared. Calculations indicate that the reactor can be assembled safely with its coolant spaces empty. (auth)

10506 AERE-T/M-81
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
CRITICAL SIZE OF A BARE HOMOGENEOUS SPHERE CONTAINING PLUTONIUM, WATER-COOLANT AND STRUCTURAL MATERIAL. J. P. Elliott. Apr. 1953. 7p.

10507 AERE-T/M-85
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
AN UPPER BOUND TO THE EFFECT OF A SLIT IN THE REFLECTOR UPON THE REACTIVITY OF A NUCLEAR REACTOR. B. Davison and P. D. Preston. June 1953. 23p.

The change of reactivity necessary to compensate for the formation of an equatorial through slit in the reflector is calculated for the case when the slit thickness t satisfies the inequalities

$$R \gg t \gg \sqrt{\frac{Rl}{\log R/t}}$$

R being the core radius and l the mean free path. The numerical calculations are carried out for the case when the mean free paths in the core and the reflector are equal and R = 1.755L, L being the diffusion length in the reflector, and it was found for this case that the change of reactivity in question is about 18% of that necessary to compensate for the complete removal of the reflector. (auth)

10508 AERE-T/M-87
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE MEASUREMENT OF THE NEUTRON SPECTRUM OF ZEPHYR BY MEANS OF A He^3 COUNTER. F. Mandl. July 1953. 7p.

The reaction $n + He^3 \rightarrow p + H^3 + 0.75$ Mev can be used to measure a neutron spectrum, by measuring the ionization pulses produced by the neutrons in a He^3 chamber. This pulse spectrum is however spoiled by He^3 recoils produced in elastic collisions with neutrons of higher energy. To deduce the neutron spectrum from the observed pulse spectrum these two effects must be separated. No difficulties arise, if the neutron spectrum contains no neutrons of more than 1 Mev energy, for in this case the two pulse spectra are quite distinct. The minimum pulse due to the reaction from a thermal neutron, is 0.75 Mev. The maximum pulse, due to a 'head-on' elastic recoil from a 1 Mev neutron, is 0.75 Mev. (auth)

10509 AERE-T/R-920
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE CRITICAL RADIUS OF A SPHERICAL INTERMEDIATE REACTOR CONSISTING OF A HOMOGENEOUS CORE SURROUNDED BY AN INFINITE REFLECTOR OF HEAVY MATERIAL. R. T. P. Whipple. Apr. 1952. 21p.

10510 AERE-T/R-1337
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
CRITICAL RADIUS OF AN UNDER-MODERATED THERMAL REACTOR WITH A REFLECTOR OF LIGHT OR HEAVY MATERIAL. M. E. Mandl and J. Howlett. Feb. 1954. 24p.

10511 BMI-746
Battelle Memorial Inst., Columbus, Ohio.
HYDROXIDES AS MODERATOR COOLANTS IN POWER-BREEDER-REACTORS. R. W. Dayton and J. W. Chastain, Jr. May 26, 1952. Decl. Nov. 17, 1955. 30p. Contract W-7405-eng-92. $4.80(ph OTS); $2.70(mf OTS).

Reflected and bare-pile two-group calculations are made for U^{233}–NaOH, U^{233}–Li^7OH, and U^{233}–Li^7OD systems, assuming spherical geometry. The core is contained by two concentric Zr shells, each 0.5 cm thick, separated by a one-cm air space. In the reflected-pile calculations, a spherical annulus filled with D_2O and ThO_2 serves as a combined reflector and breeder blanket. Reflector thicknesses of 30 and 60 cm are investigated. The nuclear constants are based on a core temperature of 1100°F, and a reflector temperature of 250°F. This core temperature is high enough for efficient power production but probably low enough to avoid excessive corrosion. In calculating breeding gains, poisoning effects are neglected, since continuous removal of the most important fission products will probably be possible in this type of reactor. The computations involving Li^7OH and Li^7OD assume essentially completely separated Li^7. With these assumptions of ideal conditions, breeding gains as high as 0.27 for Li^7OD, and 0.23 for Li^7OH are obtained. A comparison of the two reactors shows the Li^7OH moderated pile has the advantages of lower moderator cost, smaller fuel requirements, and a smaller core radius. However, the larger radius of the Li^7OD reactor would facilitate heat removal, and at the same time offer a larger breeding gain. Furthermore, the minimum fuel requirement is only 0.4% of the total mass, rather than 2% as in the Li^7OH pile. Four-tenths % of U might be dissolved in Li^7OD. (auth)

10512 CF-55-3-84
[Oak Ridge National Lab., Tenn.].
LARGE DIAMETER PIPING IN THE BASEMENT OF THE ORR BUILDING. J. P. Sanders. Mar. 15, 1955. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The combined stresses of the 18 and 24 in. reactor process water system piping in the ORR building have been calculated and are presented. (W.L.H.)

10513 CF-55-4-140
Oak Ridge School of Reactor Technology, Tenn.
APPLICATION OF THE NDA BUILD-UP FACTORS TO THE CALCULATION OF CAPTURE GAMMA HEATING IN A REACTOR PRESSURE VESSEL. L. G. Alexander. Apr. 15, 1955. 8p. Contract [W-7405-eng-26]. $1.80 (ph OTS); $1.80(mf OTS).

10514 CF-55-5-125
[Oak Ridge National Lab., Tenn.].
A FUNCTIONAL OUTLINE OF THE PROCESS WATER SYSTEM FOR THE ORR. J. P. Sanders and H. L. Watts. May 19, 1955. 19p. Contract [W-7405-eng-26]. $3.30 (ph OTS); $2.40(mf OTS).

Operations proposed for the system are summarized in order to facilitate design and construction of the piping. (T.R.H.)

10515 CF-55-7-122
[Oak Ridge National Lab., Tenn.].
PUMPS FOR MAIN CIRCULATING LOOP OF THE ORR. J. P. Sanders and H. L. Watts. July 8, 1955. 81p. Contract [W-7405-eng-26]. $13.80(ph OTS); $4.80(mf OTS).

Three main circulating pumps, one shut-down cooling pump, and one emergency cooling pump are required for the main circulating loop of the ORNL Research Reactor. Any two of the main circulating pumps shall provide the 12,000 gpm flow necessary for 20 megawatt operation. In addition, operation of three pumps simultaneously shall provide the necessary 18,000 gpm flow for 30 megawatt operation. The shut-down and emergency pumps shall provide a minimum flow of 1,000 gpm. The volume, actual

length, and equivalent length of the various piping components of the main circulating loop have been calculated and tabulated. Based on these figures, the velocities, residence times, pressure losses, and static pressures have been calculated as a function of total flow and are reported. Double-suction, single-stage, centrifugal pumps with horizontally split casings have been selected for use in this system. For the main circulating pumps, the 14-in. pump, as manufactured by Fairbanks, Morse, and Company is cited as typical of the desired pump and operating characteristics. This pump will have an 18-in.-impeller D14B1A and will require a 250 hp motor operating at 1150 rpm. For both of the other applications, the 8-in. Fairbanks, Morse, and Company pump, with an 8½ in.-impeller D8C1C1, is an example of the desired pump and operating characteristics. Use of these pumps will result in a total flow of 15,700 gpm in the main circulating loop with the operation of two main circulating pumps and no by-pass or 16,150 gpm with maximum by-pass. Three pumps result in a flow of 17,850 gpm with no by-pass and 18,550 gpm with maximum by-pass. Operation of the shut-down pump results in a flow of 1525 gpm, and operation of the emergency pump results in a flow of 1480 gpm. (auth)

10516 CF-55-8-183
Oak Ridge National Lab., Tenn.
AUXILIARY PUMPS FOR THE ORR PROCESS WATER SYSTEM. J. P. Sanders and H. L. Watts. Aug. 18, 1955. 78p. Contract [W-7405-eng-26]. $12.30(ph OTS); $4.50 (mf OTS).

Six auxiliary pumps are required for the operation of the ORR process water system. These include the primary pool cooling pump, the secondary pool cooling pump, two facility cooling pumps, the fill and drain pump, and one pool demineralizer pump. This report lists the design criteria for each of these pumps including the basis for the selection of the pump capacity. Calculations are given indicating the expected pressure loss of the various pumping loops and the resultant operating head of each of the pumps. These calculations, basic assumptions, and reference data are the same as those used to calculate the pressure loss in the main circulating loop as illustrated in ORNL CF 55-7-122. Additional information such as the system volume, pipe lengths, number and type of fittings and, where they are important, the velocities and residence times are given for each loop. With the exception of the secondary pool cooling pump, single-stage, double-suction, centrifugal pumps with side inlet and outlet have been recommended for these items. Specific manufacturer's models have been recommended for each of the applications and the characteristic curves of these models are given. (auth)

10517 CF-55-9-151
Oak Ridge National Lab., Tenn.
FLUX MEASUREMENT IN HOLE 10, ORNL GRAPHITE REACTOR. W. A. Brooksbank, Jr., J. H. Oliver, and G. W. Leddicotte. Sept. 30, 1955. 4p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

10518 CF-56-2-42
Oak Ridge National Lab., Tenn.
HRP EXPERIMENTAL VALVE PROGRAM. A. M. Billings. Feb. 14, 1956. 14p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A valve testing program directed at improved valve performance in homogeneous reactor systems is discussed. Valve trim, shaft seals, and actuators are considered. (D.E.B.)

10519 CF-56-2-137
Oak Ridge National Lab., Tenn.
PERMANENT FREEZE JACKETS FOR HRT PROCESS LINES ½" AND SMALLER. R. C. Robertson. Feb. 23, 1956. 18p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Preliminary information to make recommendations for freezing jacket designs for lines 0.5 in. and smaller is presented. Test results and fabrication problem statements to support the recommendations are included. Recommended types, along with design details, are specified for various applications. (T.R.H.)

10520 CF-56-3-72
Oak Ridge National Lab., Tenn.
GAMMA HEATING MEASUREMENTS IN THE BULK SHIELDING REACTOR. F. T. Binford, E. S. Bettis, and J. T. Howe. Mar. 7, 1956. 20p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A series of experiments to determine the rate of gamma heating in construction materials in the vicinity of a reactor core of the MTR type were carried out in the Bulk Shielding Reactor at the Oak Ridge National Laboratory. The method used employed measurement of the transient temperature of the samples during heating in the gamma field and cooling after removal from the gamma field. Results suitable for use in connection with the engineering design of reactor structures were obtained using Al, Pb, Fe, and Cu samples. (auth)

10521 CF-56-5-186
Oak Ridge National Lab., Tenn.
THE ORR REACTOR BUILDING, REACTOR STRUCTURE AND SERVICES. W. L. Wright. Apr. 19, 1956. 58p. Contract [W-7405-eng-26]. $9.30(ph OTS); $3.60(mf OTS).

A general description of the design, construction, and facilities of the ORNL Research Reactor is given. (D.E.B.)

10522 CRRP-657
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
THE PROBLEM OF FLUX INSTABILITY IN LARGE POWER REACTORS. A. G. Ward. July 26, 1956. 11p. (AECL-345).

Equations are developed which indicate the extent of flux oscillations to be expected in large power reactors with constant power output control. After the establishment of equilibrium Xe, local flux variations are magnified and must be corrected by control rod movement. This in turn promotes a shift in the instability location. (D.E.B.)

10523 GER-7491
Goodyear Aircraft Corp., Akron, Ohio.
ANALOG SIMULATION IN REAL-TIME OF XENON POISONING IN A NUCLEAR REACTOR. N. P. Tomlinson. Apr. 23, 1956. 24p.

The GEDA analog computer may be coded to predict Xe poison effects in thermal reactors. This code is developed. (D.E.B.)

10524 HW-37653
[Hanford Atomic Products Operation, Richland, Wash.]
CALCULATED PRESSURE DROP IN THE 1706-KER LOOP. D. E. Sebade. Jan. 31, 1956. 9p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

The 1706-KER recirculation system is composed of four separate piping loops which recirculate coolant liquid in closed loops to tubes for inpile testing. One of the loops is constructed of stainless steel while the three remaining loops are constructed of carbon steel. Pressure loss calculations were made for both a carbon steel loop and the stainless steel loop using 150 psi TDH, 60 gpm pumps and an average temperature of 500°F. Pressure losses of 115 psi for the carbon steel loop and 110 psi for the stainless steel loop were calculated. The near equality of pressure loss is a result of the geometry of the two loops. On the basis of these losses, 40 to 35 psi

pressure loss is required across the main flow control valve for pump operation at the design point. (auth)

10525 HW-39942

[Hanford Atomic Products Operation, Richland, Wash.].
MICROPHOTOMETER CONTROL OF WATER TREATMENT. W. R. Conley and R. W. Pitman. Nov. 18, 1955. Decl. May 11, 1956. 7p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A method of filter plant operational control has been developed which has more than doubled the design capacity of the plant. The new control method makes it possible to guarantee the quality of water filtered at 6 gpm per square foot with greater reliability than was possible with the conventional methods at 2½ gpm per square foot. (W.L.H.)

10526 HW-40919

Hanford Atomic Products Operation, Richland, Wash.
KAPL-120 HIGH PRESSURE RECIRCULATING WATER LOOP. Final Design Report. G. E. Wade and J. A. Berberet. Jan. 15, 1956. 51p. Contract W-31-109-Eng-52. $0.35(OTS).

An in-pile high temperature high pressure recirculating water loop has been installed in the A Test Hole of H Pile for KAPL. This loop permits the irradiation of experimental fuel assemblies and other reactor materials in a sizeable neutron flux which is "flat" over a distance of several feet. The loop is designed to permit the study of neutron flux effects on corrosion, water chemistry properties and stability, and irradiation of fuel or structural materials. Maximum operating conditions are flow 150 gpm, pressure 2200 psi, and temperature 610°F. Experimental assemblies up to 2.320-inches OD and 3 feet in length can be accepted. Pressure drop considerations and neutron flux requirements determine the number that can be accommodated at a given time. Instrumentation is provided to protect the reactor and take data on the performance of materials under irradiation. (auth)

10527 NARF-56-5T

Convair, Fort Worth, Tex.
CONVAIR STANDARD PILE. W. T. Scarborough. Aug. 10, 1956. 20p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-115).

A water-moderated standard pile has been designed and built to supply a non-varying, standard source of neutrons for instrument and reactor calibration, and to provide data for studies requiring an accurately-known, absolute thermal neutron flux. Au and In foils are normally used for flux measurements. The standard pile was calibrated by comparing the thermal saturated activities of foils exposed in the known flux of the ORNL standard pile to that of identical foils exposed at the same time in the Convair standard pile. A physical description of the pile and results of flux measurements are given. (auth)

10528 TID-7506(Pt. I)

Argonne National Lab., Lemont, Ill.
PAPERS PRESENTED AT THE TECHNICAL BRIEFING SESSION ON THE BOILING WATER REACTOR PROGRAM AND THE FAST REACTOR PROGRAM HELD AT IDAHO FALLS, IDAHO, NOVEMBER 1-2, 1955. July 1956. 221p. Contract W-31-109-eng-38. $1.25(OTS).

Included are 11 papers on boiling water and fast breeder reactor design, operation, and associated technology. (D.E.B.)

10529 WAPD-PM-31

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
ONE-DIMENSIONAL FEW GROUP BURNOUT CODE. Paride A. Ombrellaro. Nov. 4, 1955. 34p. Contract AT-11-1-GEN-14. $6.30(ph OTS); $3.00(mf OTS).

The few group diffusion equations with spatial dependent coefficients to be incorporated into a one-dimensional burnout code designed for the study of slab, cylindrical, and spherical reactors are described. The few group equations are derived by integrating the diffusion equation with energy and spatial dependent coefficients over a series of energy intervals. In each group, an absorption cross section, Σ_p, has been separated out to permit the adjustment of a control poison during the calculation to achieve criticality. In order to permit the treatment of finite slabs and cylinders, transverse buckling terms are included in the few group equations. This provides a means of approximating blanket control. Thus the equations provide two means by which criticality can be maintained during lifetime. (auth)

10530 WAPD-T-313

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
FRETTING WEAR OF ZIRCALOY-2 PELLETS IN HIGH TEMPERATURE WATER. Louis A. Waldman and Paul Cohen. [1956]. 28p. Contract AT-11-1-GEN-14. $4.80 (ph OTS); $2.70(mf OTS).

Pellet bed reactors using Zircaloy-2 cladding are attractive for pressurized water reactors, because of the potential simplicity of the pellet bed reactor core and the low cross-section for neutron absorption of the Zr. In such a reactor, fretting of adjacent pellets might be a problem because of the release of induced Zr activity, and, if wear is appreciable, perforation of the cladding. An investigation at fully simulated operating conditions, in which fretting wear rates were determined by using irradiated pellets is described. The results of this test were combined with observations from previous tests and an analysis made of the hazards of this type of reactor. It is shown that neither activity release or cladding penetration is seriously affected by fretting wear. (auth)

10531

ESTIMATION OF DOPPLER EFFECT IN FAST REACTORS. H. Feshbach (Massachusetts Inst. of Tech., Cambridge) and G. Goertzel and H. Yamauchi (Nuclear Development Corp. of America, White Plains, N. Y.). Nuclear Sci. and Eng. 1, 4-20(1956) Mar.

A detailed variation with energy of that part of the neutron cross section of an element which shows resonance behavior is temperature dependent. This dependence, the Doppler effect, arises from the temperature variation of neutron-nuclear relative velocity distribution. An effective cross section (dependent on reactor composition) useful in reactor calculations in place of the rapidly fluctuating actual cross section is defined. Knowledge of the variation of this effective cross section with material temperature is needed for calculation of the temperature coefficient of reactivity. Unfortunately, resolution of present measuring equipment does not permit sufficiently accurate measurement of cross sections in the energy range of interest in fast reactors (100 kev to several Mev), for Doppler effect calculation nor are direct measurements in this energy range available at present. To estimate Doppler effect, it has been assumed that in any energy range containing many resonances the actual cross section is equivalent, as far as reactor behavior is concerned, to a cross section constructed by selecting spacings between neighboring resonances and other resonance parameters independently from probability distributions of these parameters. In this manner, temperature coefficients may be calculated in terms of measured cross sections and various statistical parameters of the probability distributions, the parameters being estimated from low-energy data on actual resonances. In applying the low-energy data to the energy ranges of interest, the predictions of the

statistical model of the nucleus, as developed by Weisskopf and others, are employed. (auth)

10532

TOPSY, A REMOTELY CONTROLLED CRITICAL ASSEMBLY MACHINE. Roger H. White (Los Alamos Scientific Lab., N. Mex.). Nuclear Sci. and Eng. 1, 53-61 (1956) Mar.

A remotely operated facility for the study of reacting metal assemblies with thick reflectors is described. Design of the assembly machine permits adaptation to nuclear components of various materials and geometries. Data resulting from experimental programs on the behavior of reflected critical assemblies can be applied to fast reactor problems. (auth)

10533

RANDOM FLUCTUATIONS IN PERIOD-METER INDICATIONS. William M. Grim, Jr., Bruce B. Barrow, and John C. Simons, Jr. (Massachusetts Inst. of Tech., Cambridge). Nuclear Sci. and Eng. 1, 80-91(1956) Mar.

Measurement of reactor period at low power levels (from 10^{-10} to 10^{-5} of full power) during start-up is desirable to permit the full power level to be reached rapidly yet safely. At low flux levels, it is natural to attempt to obtain period information by differentiating the output of a logarithmic counting-rate meter. Because of the random arrival of pulses at the input of the system, however, the period indicated at the output will fluctuate about the correct value, the magnitude of the fluctuation depending upon the average counting rate and upon the system parameters. If the diode in the logarithmic circuit is replaced for incremental analysis by an appropriate linear resistor, the magnitude of the output fluctuations can be calculated by applying shot noise theory. These calculations are here carried out for the infinite-period case (constant counting rate), using the counting rate as an independent variable. Experiments were carried out, and the results agreed closely with theory. Although the present study is based on fluctuations occurring when flux is held constant, other work shows the results to be applicable also to flux transients. (auth)

10534

AN UNREFLECTED U-235 CRITICAL ASSEMBLY. R. E. Peterson and G. A Newby (Los Alamos Scientific Lab., N. Mex.). Nuclear Sci. and Eng. 1, 112-25(1956) May.

An unreflected, spherical U^{235} critical assembly has been in operation at the Los Alamos Scientific Laboratory since August, 1951. A remotely controlled mechanical system is used to assemble subcritical components of the sphere, and reactivity is adjusted with U^{235} control rods. The maximum power level during sustained operation is about 1 kw. Investigations with the assembly include studies of the neutron spectrum, observation of the changes of reactivity produced by inserting foreign materials into the assembly, and determination of parameters such as the temperature coefficient of reactivity. In addition, experiments at reactivities above prompt critical have been carried out. The assembly has also been used as a source of short, high-intensity bursts of neutrons in the study of delayed neutrons following fission. (auth)

10535

CONSTRUCTION OF THE EXPERIMENTAL FAST-BREEDER REACTOR AT DOUNREAY. Nuclear Power 1, 73-4(1956) June.

A description and diagram of the Dounreay reactor are given. Problems of construction are discussed and illustrated. (F.S.)

10536

THE ECONOMICS OF ENRICHED-FUEL REACTORS. J. M. Kay. Nuclear Eng. 1, 141-2(1956) July.

Estimates of costs show that enriched-fuel reactors based on the supply of material from diffusion plants do not appear so attractive as natural uranium reactors at comparable levels of irradiation. Using plutonium as enrichment and with appropriate re-cycling this type of reactor becomes more economical. (auth)

10537

ENGINEERING FEATURES OF CALDER HALL. Nuclear Eng. 1, 155(1956) July.

10538

MATERIALS FOR NUCLEAR POWER REACTORS. John M. Warde (Oak Ridge National Lab., Tenn.). Materials and Methods 44, No. 2, 121-44(1956) Aug.

Materials are currently the limiting factor in utilizing the vast quantities of thermal energy released by nuclear fission. Selection criteria for engineering materials used in the design and construction of nuclear power reactors include such unprecedented demands as low neutron absorption and resistance to radiation damage. This manual surveys those materials now available that can be or have been used in harnessing nuclear energy for generation of power. (auth)

10539

NUCLEAR POWER FOR COMMERCIAL VESSELS. II. K. Maddocks (Univ. of Michigan, Ann Arbor). Atomics 7, 197-201 & 224(1956) June.

A survey is presented of British and American unclassified material relative to the use of nuclear power for marine propulsion. Following a brief discussion on the principles of fission and reactor operation, five types of reactors suitable for marine use and one type suitable for fuel production are described and illustrated. The gas cooled reactor is selected as most suitable for marine propulsion and a proposed closed cycle gas turbine plant is analyzed in some detail. Various proposals for the use of nuclear power in specific ships are reviewed, and an economic analysis is made to compare a 30,000 ton d.w. tanker when operating with an oil fired steam turbine plant and when operating with a nuclear-powered closed-cycle helium turbine. (auth)

10540

FLUIDISATION TECHNIQUES AND NUCLEAR REACTORS. A SUMMARY. Atomics 7, 215-17 & 223(1956) June.

Results are presented from a preliminary survey of possible nuclear reactors employing the fluidization technique. (C.H.)

10541

NUCLEAR POWER REACTORS—SOME INSPECTION PROBLEMS. S. W. Joslin. Atomics 7, 233-6 & 259(1956) July.

A brief recapitulation of the Government program for the building of nuclear power stations by the Central Electricity Authority, and a description of a nuclear power station of the Calder Hall type are given. A few of the problems which beset an inspection organization responsible for the inspection and progress at manufacturer's works of the component parts of such a power station are mentioned. (auth)

10542

PROGRESS OF THE SHIPPINGPORT REACTOR—AMERICA'S FIRST FULL SCALE ATOMIC ELECTRICITY PLANT. Atomics 7, 238-9(1956) July.

The progress and development of the first full-scale atomic electricity plant at Shippingport are described. (J.E.D.)

10543

NUCLEAR POWER REACTORS. II. SOME INSPECTION PROBLEMS. S. W. Joslin (U. K. Atomic Energy Authority, Risley, Lancs, England). Atomics 7, 281-3(1956) Aug.

10544
FUNDAMENTAL ASPECTS OF NUCLEAR REACTOR CONTROL. M. A. Schultz (Westinghouse Electric Corp., Pittsburgh). Atomics 7, 284-90(1956) Aug.

The elementary physics of reactor control and reactor operation are surveyed. (B.J.H.)

10545
NUCLEAR POWER FOR COMMERCIAL VESSELS. III. K. Maddocks (Univ. of Michigan, Ann Arbor). Atomics 7, 291-5(1956) Aug.

A survey is given of British and American unclassified material relative to the use of nuclear power for marine propulsion. Following a brief discussion on the principles of fission and reactor operation, five types of reactor suitable for marine use and one type suitable for fuel production are described and illustrated. The gas cooled reactor is selected as most suitable for marine propulsion and a proposed closed cycle gas turbine plant is analyzed in some detail. Various proposals for the use of nuclear power in specific ships are reviewed, and an economic analysis is made to compare a 30,000 ton d.w. tanker when operating with an oil fired steam turbine plant and when operating with a nuclear-powered closed-cycle helium turbine. The first parts of this article appeared in the May and June issues. (auth)

10546
GETTING PWR ON THE LINE. L. R. Love and G. N. Oldham (Duquesne Light Co., Pittsburgh). Nucleonics 14, No. 7, 27-9(1956) July.

In June 1957 the Shippingport power station is scheduled to go critical. Plans are now being put into motion for the two aspects of the operation, cold-station startup and personnel. (W.L.H.)

10547
NUCLEAR SAFETY IN PROCESSING REACTOR FUEL SOLUTIONS. Dixon Callihan (Oak Ridge National Lab., Tenn.). Nucleonics 14, No. 7, 38-41(1956) July.

Safety factors have been presented in the processing of reactor fuel solutions. The effects of neutron leakage, moderation and density along with the design of storage vessels have been discussed. (W.L.H.)

10548
AUTOMATIC-BOILING-COLUMN REACTOR. Carl L. Leyse (Internuclear Co., Clayton, Mo.). Nucleonics 14, No. 7, 42-5(1956) July.

The ABC reactor has potential advantages over conventional boiling reactors in that blind startup is permissible, no control rods are necessary and reactor power is dependent only on feedwater rate. (W.L.H.)

10549
FUEL ENRICHMENTS FOR REACTORS FOR POWER OR RESEARCH. Nucleonics 14, No. 7, 76(1956) July.

Higher enrichment makes more neutrons available for loss due to leakage and absorption by materials and structure. The design flexibility of a power reactor can be improved by increasing U^{235} concentrations from 0.75% to 2% this doubles the number of neutrons available for leakage and absorption. (W.L.H.)

10550
ECONOMICS OF SHIPPING SPENT NUCLEAR FUEL ELEMENTS. Charles E. Dryden (General Electric Co., Schenectady, N. Y.). Nucleonics 14, No. 7, 77-80(1956) July.

Regulations for shipping, shipping cost estimates, design of shipping containers, shielding requirements and transportation for the shipping of spent nuclear fuel elements are discussed. (W.L.H.)

10551
THE USE OF RESEARCH REACTORS IN NUCLEAR POWER DEVELOPMENT. H. J. Grout (Atomic Energy Research Establishment, Harwell, Berks, England). J. Brit. Nuclear Energy Conf. 1, 35-51(1956) Jan.

The purpose of research reactors is to provide both the radiation-field and test-bed facilities to enable the behavior of reactor materials and components to be studied and tested under simulated operating conditions and to obtain fundamental information in the fields of reactor physics, chemistry and metallurgy. Not all these research and development activities can be performed in a single reactor; the present tendency is to design research reactors for fairly specific duties and the United Kingdom Atomic Energy Authority (U.K.A.E A.) have in operation or under construction reactors for the study of shielding, core geometry, materials testing and fundamental measurement. (auth)

Refer also to abstracts 9909 and 10693.

NUCLEAR TRANSFORMATION

10552 NP-6084
Naval Research Lab., Washington, D. C.
BIBLIOGRAPHY OF PHOTONUCLEAR REACTIONS. Supplement No. 1. Bibliography No. 2. M. Elaine Toms, comp. Aug. 1956. 22p.

This supplement was prepared to extend the bibliography, N.R.L. Bibliography No. 2, June 1955, through 1955. Sixteen references prior to 1955 have been added. 107 references come from the literature published in 1955. The arrangement of the supplement follows that of the bibliography. An author index for the 170 contributing authors follows the references. (auth)

10553 UCRL-Trans-241
PROCESSES OF STAR FORMATION AND FISSION PRODUCED BY 460 MEV PROTONS ON WOLFRAM AND BISMUTH NUCLEI. N. A. Perfilov and V. I. Ostroumov. Translated by Theodore Kowalski from Doklady Akad. Nauk S.S.S.R. 103, 227-8(1955). 5p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-7538. (T.R.H.)

10554
THE PHOTOPRODUCTION OF CHARGED MESONS FROM CALCIUM. W. R. Hogg and D. Sinclair (Univ. of Glasgow). Phil. Mag. (8) 1, 466-72(1956) May.

The yields of π^- and π^+ mesons from Ca have been measured at 90° to a photon beam with a maximum energy of 330 ± 10 Mev. The mesons were detected in nuclear emulsions. The ratio of the number of π^- to π^+ mesons was determined to be 0.86 ± 0.18 at a pion energy of 80 Mev. Above 95 Mev, the ratio fell rapidly to 0.39 ± 0.12 at 112 Mev. Approximate values for the cross sections for the production of π^+ and π^- mesons, as a function of pion energy, were also determined. The experimental results may be given a semiquantitative explanation by the theory of Butler (1952). Preliminary calculations by Moorhouse and Laing (private communication) are in fairly good agreement with the measured data. (auth)

10555
THE DECAY OF THE UX-COMPLEX. Ong Ping Hok, J. Th. Verschoor, and P. Born (Natuurkundig Laboratorium der Vrije Universiteit, Amsterdam). Physica 22, 465-80(1956) May.

The radiations of the UX-complex and of pure UZ were reinvestigated by means of a double-focusing beta-ray spectrometer and a gamma-scintillation spectrometer. A rapid method was worked out to obtain relative pure UX_2 samples. The gamma-rays were measured with a photographical method. Sixteen gamma-transitions were found in UZ and twelve in UX_2; five of these transitions seemed

to occur in both decays. From these data and a $\beta-e^-$ coincidence measurement in UX_1 a tentative level scheme of the UX-complex was set up. The UZ-level proved to be the ground state of ^{234}Pa, 60 ± 15 kev below the UX_2 level. (auth)

10556

THE STATISTICAL THEORY OF NUCLEAR REACTIONS. C. Bloch (Centre d'Études Nucléaires, Saclay). J. phys. radium 17, 510-15(1956) July. (In French)

A very elementary account of the general principles of the statistical theory of nuclear reactions in the intermediate energy range is presented. It seems possible to define a model allowing predictions of averaged cross-sections not only for elastic scattering of neutrons, but also for nuclear and photonuclear reactions. (auth)

10557

PHOTOPROTON SPECTRA FROM COPPER IRRADIATED WITH 14.8- and 17.6-MEV γ RAYS. R. Chastel (College de France, Paris). J. phys. radium 17, 518(1956) July. (In French)

10558

STUDY OF THE TRANSMUTATION OF COPPER BY NITROGEN, OXYGEN, AND NEON. H. Faraggi, J. Olkowsky, J. Beydon, M. Crut, R. Chaminade, and A. Papineau. J. phys. radium 17, 519-20(1956) July. (In French)

A study was made of the relative yields of the radioelement formed in the transmutation of copper by nitrogen, oxygen and neon. The most probable mechanism of these reactions is the formation of a compound nucleus resulting from the addition of the two nuclei and followed by the evaporation of a few nucleons. Nevertheless, the quantitative comparison of experimental yields with prediction of the evaporation theory shows certain discrepancies. (auth)

10559

STUDY OF THE DOPPLER EFFECT OF γ RAYS FROM THE REACTION $B^{10}(\alpha,p)C^{13}$. R. J. Mackin, W. R. Mills, and J. Thirion. J. phys. radium 17, 551-2(1956) July. (In French)

The Doppler shift of the gamma rays (3.64 and 3.84 Mev) from the reaction $B^{10}(\alpha,p)C^{13}$ has been studied. The gamma ray at 3.64 Mev is the only one to exhibit a Doppler shift. These results indicate lifetimes shorter or longer than 3×10^{-13} s. (auth)

10560

STUDY OF THE VARIATION OF THE NUMBER OF NEUTRONS EMITTED BY THE FISSION OF Pu^{239} IN THE THERMAL AND DPI-THERMAL REGIONS. J. M. Auclair, M. Jacob, and H. Landon (Neutronique Experimentale, Saclay). J. phys. radium 17, 563(1956) July. (In French)

The study of the variation of the average number of neutrons emitted per fission of Pu^{239} as a function of the energy of the incident neutron shows that within an accuracy of about 1% this number is constant from thermal energy up to several electron-volts. (auth)

10561

EFFECTIVE FISSION CROSS SECTIONS BY NEUTRONS BETWEEN 1 AND 3 MEV. F. Netter, J. Julien, C. Corge, and R. Ballini (Physique Nucléaire, Saclay). J. phys. radium 17, 565(1956) July. (In French)

A determination was made of fast neutron fission cross sections of U^{233} and Pu^{239} between 1 and 3 Mev with a Van de Graaff accelerator. (auth)

10562

AN EFFECTIVE CAPTURE CROSS SECTION OF Np^{239} FOR THERMAL REACTOR NEUTRONS. J. Halperin and R. W. Stoughton (Oak Ridge National Lab., Tenn.); C. M. Stevens (Argonne National Lab., Lemont, Ill.); and D. E. Ferguson and D. Overholt (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 1, 108-11(1956) May.

Depleted uranium was irradiated in the thermal neutron flux of the Low Intensity Test Reactor at Oak Ridge National Laboratory. From mass spectrographic analysis of Pu^{240} and from chemical determination of Pu content, the effective capture cross section (including both thermal and epithermal neutron capture) was determined for Np^{239} to be 80 ± 15 barns. (auth)

10563

RADIOACTIVE DECAY OF RUTHENIUM-95. Eduardo Schalscha (Instituut voor Kernphysisch Onderzoek, Amsterdam). Nuclear Phys. 1, 481-5(1956) June.

Ruthenium 95, produced by a (n,2n) reaction, was studied by scintillation spectrometry, and the half-life and position energy were determined by magnetic deflector and absorption measurements in Geiger-Müller beta counters. The isotope decays with a half-life of 1.65 ± 0.05 h by emission of positions with a maximum energy of 1.2 ± 0.1 Mev and by electron capture combined with emission of γ-rays of 145, 340, 640 and 1110 kev. Nuclear level schemes are discussed. (auth)

10564

(p,He^3) AND (p,t) CROSS-SECTION MEASUREMENTS. G. H. McCormick, H. G. Blosser, B. L. Cohen, and E. Newman (Oak Ridge National Lab., Tenn.). J. Inorg. and Nuclear Chem. 2, 269-70(1956) July.

The (p,He^3) cross sections of Ga^{71}, Ca^{40}, and Ca^{44}, and the (p,t) cross sections of Cu^{63} and Fe^{54} were determined. Results indicate no need for a sizeable many-body correction in computing probabilities for emission of He^3 and H^3 nuclei. (C.W.H.)

10565

THE SLOW-NEUTRON ABSORPTION CROSS-SECTION OF 9.2-H Xe^{135} BY THE METHOD OF NEGATIVE ACTIVATION. M. S. Freedman, A. Turkevich, R. M. Adams, N. Sugarman, S. Raynor, and L. B. Stang, Jr. (Argonne National Lab., Lemont, Ill.). J. Inorg. and Nuclear Chem. 2, 271-85(1956) July.

The absorption cross-section of 9.2-hr Xe^{135} for thermal (pile) neutrons was measured, using 2 variants of the method of negative activation. The value obtained is 2.58 ± 0.20 × 10^{-18} cm^2/atom for a mean neutron temperature of 400°K in a reactor moderated by heavy water. (auth)

10566

SPONTANEOUS FISSION HALF-LIFE OF Cm^{246}. S. M. Fried, G. L. Pyle, C. M. Stevens, and J. R. Huizenga (Argonne National Lab., Lemont, Ill.). J. Inorg. and Nuclear Chem. 2, 415-16(1956) July.

A value of (2.0 ± 0.8) × 10^7 years has been obtained for the spontaneous fission half life of Cm^{246}. (C.W.H.)

10567

ORDINARY WIDTH OF INTERNAL CONVERSION LINES FOR ACTIVE PRECIPITATED RdTh. G. D. Latyshev, A. G. Sergeev, E. M. Krisyuk, L. A. Ostretsov, Yu. S. Egorov, and N. M. Shirshov (Obraztsov Leningrad Inst. of Transportation). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 354-62(1956) Mar. (In Russian)

The F line of active precipitated RdTh, produced by the γ quantum conversion on the K-shell of Bi^{212} atom, has a natural width of 67 ± 5 ev. The ordinary width of G lines produced by the conversion of Bi atom K shells and the ordinary widths of H and L lines from the conversion on P^{208} atom K shell, coincide, within the limits of error, with the above value. Direct data for K-level ordinary widths for atoms Z = 83 are not available. Nevertheless, it is known that ordinary widths of atomic levels vary according to Z^4, which has been experimentally checked up to Z = 79. By extrapolation up to Z = 83, the value of 61 to 63 ev has been obtained for Bi atom K-level width. The ordinary width for

K-conversion lines, coincide, within the measured limits, with the above value. This fact indicates that the ordinary conversion lines are determined by the width of the atomic levels and depend, considerably, on the effects which accompany the internal conversion. (R.V.J.)

10568

FISSION OF URANIUM BY SLOW π^- MESONS, FAST NEUTRONS AND γ-RAYS OF ENERGIES UP TO 250 MEV. G. E. Belovitskii, T. A. Romanova, L. V. Soukhov, and I. M. Frank (P. N. Lebedev Physical Inst., Academy of Sciences, U.S.S.R.). Soviet Phys. JETP 2, 493-508(1956) May. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 537-50(1955) Nov. (In Russian)

The fission of uranium by slow π^- mesons, fast neutrons and high energy γ rays has been studied by use of thick photographic plates. It has been found that there is a high probability that the uranium nucleus will undergo fission when it captures a π^- meson. This probability is close to 0.5. At high energies of excitation, fission is often accompanied by the emission of charged particles—protons and α particles. The energy distribution and angular distribution of these particles were determined. The mechanism of the fission of uranium at high excitation energies is discussed on the basis of these observations. (auth)

10569

FISSION OF HEAVY NUCLEI BY SLOW π^- MESONS. N. A. Perfilov and N. S. Ivanova (Radium Inst., Academy of Sciences, U.S.S.R.). Soviet Phys. JETP 2, 433-40(1956) May. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 551-8 (1955) Nov. (In Russian)

Experimental data are given showing that on capture of slow π^- mesons by nuclei of U, Pb, and W, fission of these nuclei occurs. Of the three nuclei studied, the fission probability is greatest for uranium, for which more than 300 cases of fission by slow π^- mesons were found. The distribution in range of the fission fragments and the existence of cases of fission with emission of fast charged particles (principally protons) show that in the end result the capture of a slow π^- meson by a nucleus is similar to the action on it of a particle with high (~100 mev) energy. (auth)

10570

ON THE CORRELATION METHOD FOR THE DETERMINATION OF THE ABSOLUTE YIELD OF NUCLEAR REACTIONS. V. I. Gol'danskii and M. I. Podgoretskii (P. N. Lebedev Physical Inst., Academy of Sciences, U.S.S.R.). Soviet Phys. JETP 2, 441-50(1956) May. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 559-71(1955) Nov. (In Russian)

An examination has been made of the statistical method of investigating nuclear transformations and of determining their absolute yield and mechanism. The method is based on measurement of the magnitude of the correlation function between the observed transformations of various types. The correlation function and its dispersion have been calculated (in the absence and in the presence of background), and the question of the accuracy of the method has been examined. The well-known method of coincidences is a special case of the correlation method, which is also applicable for longer time intervals between related transformations at high radiation intensities. (auth)

10571

THE (d,p) REACTION ON HEAVY NUCLEI. K. A. Ter-Martirosian (Leningrad Physico-Technical Inst., Academy of Sciences, U.S.S.R.). Soviet Phys. JETP 2, 620-35(1956) July. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 713-29(1955) Dec. (In Russian)

The differential cross section for the (d, p) reaction on a heavy nucleus is calculated for the case where the effect of the Coulomb field is fundamental in determining the angular distribution. The differential cross section over the region of large angles increases with increasing angle, while the behavior of the cross section is weakly dependent on the angular momentum, l_n, of the state into which the neutron is captured. The total cross section is determined and the factor multiplying the exponential is estimated. (auth)

10572

FISSION OF HEAVY NUCLEI BY HIGH ENERGY NEUTRONS. V. I. Gol'danskii, V. S. Pen'kina, and E. Z. Tarumov (Academy of Sciences, U.S.S.R.). Soviet Phys. JETP 2, 677-87(1956) July. Zhur. Eksptl.' i Teoret. Fiz. 29, 778-89(1955) Dec. (In Russian)

Results of experiments on the fission of various heavy nuclei in the region Z = 74 to 92 by neutrons of nominal energy of 120 and 380 Mev are presented. An evaluation of threshold for fission connected with previous neutron emission is based on a comparison of the binding and critical fission energies. The average number of neutrons emitted during the fission of a heavy nucleus is evaluated. (auth)

10573

RADIATIVE CAPTURE OF THERMAL NEUTRONS WITHOUT FORMATION OF A COMPOUND NUCLEUS. L. K. Peker. Soviet Phys. JETP 2, 753-4(1956) July. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 865-6(1955) Dec. (In Russian)

It is shown that the reaction Pb^{206} (n,γ) Pb^{207} occurs without the formation of a compound nucleus. (B.J.H.)

10574

CAPTURE OF THERMAL NEUTRONS BY ISOTOPES OF LEAD. A. V. Shut'ko and D. F. Zaretskii. Soviet Phys. JETP 2, 769-71(1956) July. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 866-8(1955) Dec. (In Russian)

The magnitude of the cross section for capture of thermal neutrons by Pb^{207} is evaluated. Remarks concerning the energy level schemes of several Pb isotopes are included. (B.J.H.)

10575

TOWARDS A STATISTICAL THEORY OF FISSION WIDTH. V. G. Nosov (Academy of Sciences, U.S.S.R.). Soviet Phys. JETP 2, 746-7(1956) July. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 880-1(1955) Dec. (In Russian)

A brief examination is made of the possible connection between different rates of fission width obtained by various workers. (B.J.H.)

10576

A COMPARISON OF THE AVERAGE NUMBER OF NEUTRONS EMITTED IN FISSION OF SOME URANIUM AND PLUTONIUM ISOTOPES. J. E. Sanders (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 2, 247-54(1956) June.

Measurements of the relative prompt neutron yields per fission of U^{233}, U^{235}, Pu^{239}, and Pu^{241} by thermal neutrons are described. A coincidence technique is employed. Absolute values have been determined using a natural uranium spontaneous fission source to calibrate the neutron detector. (auth)

10577

INTERPRETATION OF THE $H^3(p,n)$ REACTION. W. Selove (Harvard Univ, Cambridge, Mass.). Phys. Rev. 103, 136-41(1956) July 1.

The angular and energy dependence of the $H^3(p,n)$ reaction at energies up to a few Mev have been much analyzed for their possible indication of resonances in the "compound nucleus" He^4. It is shown that the experimental data can be explained on the basis of "direct" interactions, without assuming that any compound-nucleus state is in-

volved. A combination of "knock-on" and "pickup" effects is involved. In addition to removing the $H^3(p,n)$ data as evidence for an excited state of He^4, the result of this work adds to previous evidence that the Born approximation can give a good account of the angular and energy variations in nuclear rearrangement collisions, even at energies as low as a few Mev. (auth)

10578

ALPHA SPECTRUM IN THE $Li^7(p,\gamma)Be^{8*}(\alpha)He^4$ REACTION. E. C. LaVier, S. S. Hanna, and R. W. Gelinas (Johns Hopkins Univ., Baltimore). Phys. Rev. 103, 143-5(1956) July 1.

The alpha-particle spectrum in the $Li^7(p,\gamma)Be^{8*}(\alpha)He^4$ reaction was observed with magnetic analysis from 1.0 to 5.5 Mev, corresponding to excitation energies in Be^8 from 2 to 11 Mev. In addition to the well-known structure at E_{ex} = 2.9 Mev, very broad structure in the region of E_{ex} = 10 Mev was observed. No evidence was obtained for the existence of levels between 3 and 10 Mev. (auth)

10579

COMPOUND NUCLEUS EFFECTS IN DEUTERON REACTIONS: $C^{13}(d,p)C^{14}$. Jerry B. Marion and Gustav Weber (California Inst. of Tech., Pasadena). Phys. Rev. 103, 167-71(1956) July 1.

By using an angular distribution chamber with observation ports at 5° intervals from 5° to 165°, the $C^{13}(d,p)C^{14}$ reaction has been studied as a function of the bombarding energy and angle of observation over the range of deuteron energy from 0.6 Mev to 3.0 Mev. A CsI crystal, with a resolution of 4.5 percent for the ground state protons from C^{13} + d, was used as a detector. Excitation curves were obtained at angles of 20° and 135°. A number of broad maxima were observed, the most pronounced effects occurring near $E_d \cong 1.4$ Mev. Twelve angular distributions were measured, at E_d = 0.64, 0.78, 0.87, 0.98, 1.23, 1.39, 1.48, 1.58, 1.74, 1.99, 2.36, and 2.84 Mev. Those distributions obtained below 1.5 Mev are well described by a power series expansion in $\cos\theta$, involving terms up to $\cos^4\theta$. The variation with energy of the angular distributions suggests that for these low bombarding energies the major part of the cross section is probably due to compound nucleus formation. For energies above 1.7, a maximum in the distributions occurs near $\theta \cong 25°$. This peak becomes more pronounced at the higher energies and indicated for $E_d \gtrsim 1.7$ Mev, the stripping process becomes increasingly important. (auth)

10580

SPALLATION OF YTTRIUM BY 240-MEV PROTONS. Albert A. Caretto, Jr. and Edwin O. Wiig (Univ. of Rochester, N. Y.). Phys. Rev. 103, 236-9(1956) July 1.

The individual cross sections of 36 nuclides resulting from the inelastic interaction of 240-Mev protons on yttrium were determined. The results were found to be in agreement with the current theories of high-energy nuclear reactions. By means of interpolated cross sections for the stable nuclei produced in the reactions, it was possible to estimate the total inelastic cross section for yttrium with 240-Mev protons. By use of this value and application of the optical model, r_0 for Y^{89} was found to 1.21×10^{-13} cm and the nuclear transparency about 17%. (auth)

10581

MASS SPECTROMETRICALLY DETERMINED INDEPENDENT YIELDS OF I^{128}, I^{130}, Br^{80}, AND Br^{82} FOR U^{233}, U^{235}, AND Pu^{239} FISSION. T. J. Kennett and H. G. Thode (McMaster Univ., Hamilton, Ont., Canada). Phys. Rev. 103, 323-7(1956) July 15.

The primary yields of the shielded nuclei I^{128} and I^{130} have been accurately determined for the thermal neutron fission of U^{233}, U^{235}, and Pu^{239}. This has been done by the measurement of their stable daughters Xe^{128} and Xe^{130} using sensitive mass spectrometric techniques. The values of these primary yields show marked deviations from those predicted by the present theories of charge distribution. This discrepancy can be explained if the effect of the 50 proton shell is taken into account in the evaluation of the most probable initial nuclear charge Z_p for mass numbers 128 and 130. This can be done by postulating a most probable charge which will yield the greatest energy release in the fission process. Also the primary yields of Br^{80} and Br^{82} were determined by means of their daughters Kr^{80} and Kr^{82} for the thermal fission of U^{233} and U^{235} and for the fast fission of Pu^{239}. The yields of these nuclei for fast neutron fission were ~100 times those for thermal fission, indicating a shift in the charge distribution curve with neutron energy. (auth)

10582

$B^{10}(n,t2\alpha)$ AND $B^{10}(n,dn'2\alpha)$ REACTIONS FOR 6-20 MEV NEUTRONS. Glenn M. Frye, Jr. and Juanita H. Gammel (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 103, 328-34(1956) July 15.

In a set of B^{10}-loaded C-2 emulsions exposed to eight neutron energies in the range 6 to 20 Mev, 1541 three-prong stars were found which were caused by either the $B^{10}(n,t2\alpha)$ or the $B^{10}(n,dn'2\alpha)$ reaction. The triton cross section at 14 Mev is 102 ± 17 mb and decreases with increasing bombarding energy, while the deuteron cross section is 128 ± 19 mb and increases slightly with energy. The triton reaction proceeds partially through the 4.61-Mev state in Li^7 and partially as a three-body breakup. In the deuteron reaction the following intermediate nuclei are formed: Be^9, 2.43-Mev state; Be^8, ground state and possibly the 2.9-Mev level; Li^7, 10.8- and 12.4-Mev levels; and Li^6, 2.19-Mev level. Four examples were found of the $N^{14}(n,t3\alpha)$ reaction. The feasibility of using the $B^{10}(n,t2\alpha)$ reaction as a neutron monitor is discussed. (auth)

10583

REACTION $B^{11}(n,\alpha)Li^8(\beta^-)Be^{8*}(2\alpha)$ FOR 12- TO 20-MEV NEUTRONS. Alice H. Armstrong and Glenn M. Frye, Jr. (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 103, 335-40(1956) July 15.

Ilford 200-μ C-2 plates loaded with B^{11} were exposed to monoenergetic neutrons produced at nine angles to a 3.5-Mev deuteron beam incident upon a tritium gas target. Measurements of range and space angles were made upon 450 "hammer stars" which were found to result from $B^{11}(n,\alpha)Li^8(\beta^-)Be^{8*}(2\alpha)$ reaction. The cross sections in mb as a function of energy in Mev are as follows: 12.6 Mev, 27.0 ± 6.5 mb; 13.0, 38.4 ± 7.4; 14.7, 30.9 ± 6.3; 15.4, 36.9 ± 7.0; 16.9, 21.9 ± 3.6; 17.6, 23.7 ± 4.8; 18.9, 19.7 ± 3.7; 19.8, 16.3 ± 3.1; 20.0, 15.8 ± 3.1. The angular distribution of the alpha particles from the (n,α) reaction is obtained at each energy. In nearly all cases the Li^8 is left in the ground state or in the first excited state of 1 Mev. The Be^8 disintegration goes through the broad 3-Mev level and possibly a lower level near 2 Mev. A range-energy relation is found for Li^8 in Ilford C-2 emulsion. Comparison with previous experimental results shows closest agreement with Barkas. (auth)

10584

NEUTRONS FROM THE PROTON BOMBARDMENT OF B^{11}. F. Ajzenberg-Selove, G. D. Johnson, and A. Rubin (Boston Univ.) and M. Mazari (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 103, 356-7(1956) July 15.

A thin target of isotopic boron has been bombarded with 7.03-Mev protons. The neutrons from the $B^{11}(p,n)C^{11}$ reaction, studied by means of nuclear emulsions, indicate an excited state of C^{11} at 2.01 ± 0.06 Mev. (auth)

10585

PRODUCTION OF μ-MESON PAIRS BY PHOTONS. G. E.

Masek, A. J. Lazarus, and W. K. H. Panofsky (Stanford Univ., Calif.). Phys. Rev. 103, 374-7(1956) July 15.

Further measurements are reported on the anisotropic component of μ^- mesons from bombardment of an aluminum target by 600-Mev bremsstrahlung. As reported previously, such a forward peaking is interpreted as evidence for the direct electromagnetic production of muon pairs. Combining our new data with those previously reported, a value of 1.42 ± 0.34 (standard deviation) is obtained for the ratio of the observed negative-muon cross section to that calculated by assuming the muons to originate as spin-½ pair fragments from electromagnetic production in the Coulomb field of an aluminum nucleus of finite size. The absolute normalization is believed correct to within a factor of 1.4. However, the theoretical value considers only the contribution from processes leaving the aluminum nucleus in its ground state; inelastic processes could raise the theoretical value by 40%. Measurements carried out with 450-Mev bremsstrahlung yielded a value of μ^- counts at 12° relative to those at 23° equal to 0.0002 ± 0.0083, while the value observed at 600 Mev is 0.032 ± 0.009 in units of the π^+ counts observed at those two energies. This result makes it very unlikely that the forward peaking observed originates from μ mesons derived from π-μ decay. We conclude on the basis of these measurements that the process of direct electromagnetic production of muon pairs exists, and that the yield is compatible with the theory outlined. Measurements carried out on a lead target place only an upper limit on the cross section in lead. This limit (if taken at three standard deviations) gives a value ten times lower than the μ-pair cross section calculated for a point lead nucleus, but compatible with a nucleus of the accepted nuclear radius. This result makes it very unlikely that muon scattering in the range of momentum transfers near 50 Mev/c could give anomalous results. (auth)

10586

NONFISSION INELASTIC EVENTS IN URANIUM AND THORIUM INDUCED BY HIGH-ENERGY PROTONS. M. Lindner and R. N. Osborne (Univ. of California Radiation Lab., Livermore). Phys. Rev. 103, 378-85(1956) July 15.

Activation cross sections for about thirty products of high-energy proton-induced disintegration of U^{238} and Th^{232} have been measured by the radiochemical method. These products range from polonium (Z = 84) to neptunium (Z = 93). The energy dependence of some of these cross sections has been determined for formation from U^{238}. Because of fission competition, the spallation cross section of U^{238} is considerably less than that of Th^{232}. The data suggest that light isotopes of uranium are primarily responsible for the fission generally associated with high-energy particle bombardment of U^{238}. (auth)

10587

RADIOCHEMICAL STUDIES OF THE INTERACTION OF LEAD WITH PROTONS IN THE ENERGY RANGE 0.6 TO 3.0 BEV. R. Wolfgang, E. W. Baker, A. A. Caretto, J. B. Cumming, G. Friedlander, and J. Hudis (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 103, 394-403 (1956) July 15.

Lead targets have been bombarded with protons of several energies between 0.6 and 3.0 Bev and formation cross sections have been determined for about 30 nuclides of A < 140 produced in these bombardments. The excitation functions, both for the lightest products studied (A < 35) and for neutron-deficient barium isotopes, rise steeply with increasing energy. For intermediate-mass products (50 < A < 120), the changes in formation cross sections with increasing energy are much smaller and may largely be interpreted as a shift towards more neutron-deficient products and as a broadening of the yield-mass distribution. At 3 Bev the spallation and fission product regions have merged, and the cross sections for forming all mass numbers below the target mass are equal within an order of magnitude. The changes in yield pattern above about 0.4 Bev are shown to be associated with increasing probabilities of very large energy transfers (of the order of 1 Bev) from the incident proton to the struck nucleus, and this trend is explained in terms of an energy transfer mechanism involving the production, scattering, and reabsorption of pions. Besides the well-known modes of de-excitation—particle evaporation (spallation) and fission—a new mode termed fragmentation is postulated to account for some of the observed products, especially the light fragments. Fragmentation is thought to be associated with the short mean free paths of pions in nuclear matter which cause local heating and can thus lead to dissociation of the nucleus into fragments in a time short compared to that required for equipartition of energy. (auth)

10588

PION PRODUCTION IN H AND Be BY 1.0- AND 2.3-BEV PROTONS. Luke C. L. Yuan and S. J. Lindenbaum (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 103, 404-12(1956) July 15.

The energy spectra of positive and negative pions produced in H and Be by 1.0- and 2.3-Bev protons have been observed at 32° in the laboratory system. A fast scintillation counter telescope, including a magnet to select momenta, was used to analyze the direct 32° beam of particles proceeding from a straight section of the Brookhaven Cosmotron. The pion spectra were transformed to the nucleon-nucleon center-of-mass system and were observed to be essentially similar in shape to the $\pi^+ + p$ interaction cross section as a function of energy in the center-of-mass system. It was concluded that this interaction, which is believed to be due to the formation of a nucleon isobar with angular momentum and isotopic spin = ³/₂, dominates the meson production process in the 1.0- to 2.3-Bev range. The assumption of a model, whereby meson production proceeds through excitation of one or both of the colliding nucleons to this isobar which subsequently decays by pion emission, resulted in a general qualitative explanation of the results, and also gave quantitative π^+/π^- ratios in agreement with these experiments. The Fermi statistical theory was found, in general, to be contradicted by these results. (auth)

10589

CROSS SECTION FOR $C^{12}(p,pn)C^{11}$. A. H. Rosenfeld, R. A. Swanson, and S. D. Warshaw (Univ. of Chicago). Phys. Rev. 103, 413-19(1956) July 15.

The cross section for the reaction $C^{12}(p,pn)C^{11}$ has been measured at a proton energy of 461 Mev; the result is σ = 31 mb with an associated error of 3 percent. Because of some disagreement among earlier experiments by several laboratories, a detailed discussion of the errors involved in those measurements is given, and in particular, a discussion of the techniques used for positron counting in a 4π proportional counter. A summary of the present state of knowledge of this reaction is presented. (auth)

10590

NEUTRON THRESHOLDS IN THE DEUTERON-BOMBARDMENT OF NEON. Jerry B. Marion (California Inst. of Tech., Pasadena) and J. C. Slattery and R. A. Chapman (Rice Inst., Houston, Tex.). Phys. Rev. 103, 676-8(1956) Aug. 1.

The counter ratio technique has been used to detect neutron thresholds in the deuteron bombardment of Ne. Energy levels in Na^{21}, observed in the $Ne^{20}(d,n)Na^{21}$ reaction, were found at 1.46 ± 0.04 and 2.426 ± 0.037 Mev. The latter state is

bound by only 26 ± 8 kev from dissociation into Ne^{20} + p and will influence the cross section for the $Ne^{20}(p,\gamma)Na^{21}$ reaction at low energies. Two additional thresholds were observed which are attributed to the $Ne^{22}(d,n)Na^{23}$ reaction. The neutron yield indicates that for bombarding energies above 2.5 Mev a large fraction of the neutrons from the $Ne^{20}(d,n)Na^{21}$ reaction leave Na^{21} in the excited state at 2.43 Mev. (auth)

10591

NUCLEON TUNNELING IN N^{14} + N^{14} REACTIONS. G. Breit and M. E. Ebel (Yale Univ., New Haven, Conn.). Phys. Rev. 103, 679-701(1956) Aug. 1.

The tunneling process is considered as a partial explanation of observations by Reynolds and Zucker on the reactions $N^{14}(N^{14},N^{13})N^{15}$ and $N^{14}(N^{14},C^{13})O^{15}$. The theory of reactions of this type is first formulated in reasonably general terms, employing a classical mechanics treatment of the motion of the colliding nuclei and of the reaction products. The starting point is a set of adiabatic (fixed centers of mass of heavy aggregates) wave functions, which is transformed to a related system of functions insuring a better initial convergence of the iteration procedure. The anisotropy of transfer inherent in the p-nucleon eigenfunctions is taken into account but finally eliminated by the consideration of extreme j-j coupling shell structure eigenfunction assignments, as well as the spin and statistics of the nuclei. The effect of antisymmetrizing the wave function with respect to neutrons and protons in the incomplete shells is worked out. The relation of the angular distribution problem presented by the case of dominant Coulomb effects to a popular form of stripping theory is discussed, with the conclusion that the classical dynamics approximation to the motion of the colliding nuclei is adequate. The dependence of the total cross section on energy and of the differential cross section on angle, when compared with experiment, indicates the presence of another reaction mechanism participating especially at the lower energies. (auth)

10592

EXCITATION FUNCTIONS FOR (d,χn) REACTIONS ON LEAD. Walter John, Jr. (Univ. of California, Berkeley). Phys. Rev. 103, 704-13(1956) Aug. 1.

The excitation functions for α-induced reactions on Pb have been measured. A procedure has been developed for preparing enriched Pb isotope targets by evaporation. Stacked foils were bombarded by the α-beam of the 60-inch cyclotron. The induced Po α activities were separated by α pulse-height analysis. The measured excitation functions for Pb^{206} + α are compared to the excitation functions for Bi + p. Since the compound nucleus formed is the same, the comparison gives a test of the predictions of Bohr's compound nucleus theory. The ratios of corresponding cross sections are in agreement with the compound nucleus theory. However, the excitation functions are displaced in energy by an amount not predicted by the theory. The disagreement is just outside of the experimental errors. The comparison of Ni^{60} + α and Cu^{63} + p made by Ghoshal has been checked with more recent mass values, revealing a larger energy discrepancy. The excitation functions for reactions on various Pb isotopes are found to be very similar. However, the excitation functions are found to be displaced in energy by an amount not exactly equal to the differences in thresholds. (auth)

PARTICLE ACCELERATORS

10593 AERE-N/M-70

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

DELAYED NEUTRONS FROM THE BOOSTER. M. J. Poole. June 29, 1954. 6p.

A formula is presented for use in calculating the contribution of delayed neutrons from the booster to the neutron spectrum from a linear accelerator. A time-of-flight spectrometer was employed for neutron detection in the sample calculation included. (C.H.)

10594 AERE-T/M-139

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

PERTURBATION FORMULAE FOR HILL'S EQUATION. M. Bell. July 1956. 10p.

Approximate expressions are derived for the oscillation frequency of solutions of Hill's equation, applicable in the first stable zone. This type of equation occurs in focusing systems where there is a periodic focusing force superimposed on a steady one. (auth)

10595 CERN-56-20

European Organization for Nuclear Research, Geneva.

PARTICLE ORBITS IN CIRCULAR ACCELERATORS. H. Steinwedel. July 1, 1956. 50p.

The theory of charged particle motion in circular orbit accelerators is developed. The nature of acceleration in betatrons, cyclotrons, synchrocyclotrons, and synchrotrons is discussed, and the equations for describing orbital motion are given. (D.E.B.)

10596 MURA-LWJ-12

Michigan. Univ., Ann Arbor and Midwestern Universities Research Assn., Urbana, Ill.

THE OHKAWA INTERSECTING BEAMS MACHINE. Lawrence W. Jones. Aug. 16, 1956. 10p. $1.80(ph OTS); $1.80(mf OTS).

Ohkawa has suggested a geometry for intersecting beams in which particles of the same charge travel in opposite directions in a single accelerator. This is achieved with fields which reverse periodically with azimuth around a circle and which increase radially. Since the amounts of Fe, Cu, power, R.F., etc., required in this case are characteristic of one machine only instead of two, and since stacked beams would intersect 2N (where N is the number of sectors) times around the machine instead of at only one point, some possible design parameters to determine to what extent such a machine would be feasible are considered. (auth)

10597 NP-6063

European Organization for Nuclear Research, Geneva.

COHERENT METHOD OF ACCELERATION OF PARTICLE BUNCHES. (Paper presented at CERN Symposium, 1956). V. I. Veksler. 16p.

The possibility of achieving particle energies in the neighborhood of 10^{12} ev by accelerating bunches of particles by interaction with other bunches, plasma, or electromagnetic waves is discussed. In this method of acceleration, the magnitude of the accelerating field is proportional to the number of particles in the bunch, synchronization of the bunch and field are automatic, field emission breakdown is avoided, and neutron bunches may be accelerated. (D.E.B.)

10598 UCRL-3427

California. Univ., Berkeley. Radiation Lab.

A NEW METHOD FOR CONTROLLING THE MAGNETIC FIELD IN THE APERTURE OF SYNCHROTRONS. Harry G. Heard. May 23, 1956. 12p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

A new feedback method for controlling the magnetic field in the aperture of a synchrotron is disclosed. The principle has been tested in the Bevatron by use of a self-energized connection. A reduction in the magnetic-field ripple of 3.6:1 was obtained at the injection field of 300 gauss, and 8.4:1 at 15,500 gauss. Extension of this method to control the rate of rise of magnetic field is

discussed. The effect of reduced magnetic-field ripple is demonstrated by the elimination of magnet-ripple structure from the secondary beam at 6.2 Bev. (auth)

10599 UCRL-3462
California. Univ., Berkeley. Radiation Lab.
MNEMONIC AND A CALCULATING DEVICE FOR RELATIVISTIC PARTICLE DYNAMICS. Frank S. Crawford, Jr. July 8, 1956. 7p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

Several of the formulae encountered most frequently in relativistic particle dynamics problems are written in a form that exhibits clearly the transition between the nonrelativistic and extremely relativistic limits. The exact relativistic formulae in this form are related to the usual nonrelativistic formulae by the mnemonic device, "To the rest energy of each moving particle add one half of the total c.m. system kinetic energy." It is pointed out that the exact relativistic formulae so obtained are in the form best suited to rapid slide-rule calculation; the problem of "disappearing significant figures," which ordinarily forces one to use a calculating machine to obtain final slide-rule accuracy, is automatically avoided. Also avoided are the usually encountered radicals with affixed plus or minus signs. Numerical examples are given for each formula. (auth)

10600 UCRL-3464
California. Univ., Berkeley. Radiation Lab.
DESTRUCTION OF STORED CYCLOTRON BEAM BY COULOMB SCATTERING. Frank S. Crawford, Jr. July 8, 1956. 18p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

Time dependence of the probability distribution function G(A,t) is considered for the amplitude A of the vertical oscillation of a charged particle circulating at a radius R in a cyclotron, under the influence of multiple Coulomb scattering by residual gas atoms. If the amplitude A becomes equal to the dee half aperture d the particle strikes the dee and is lost from the circulating beam. It is found that G obeys the diffusion-type differential equation $\partial G/\partial t = D_2\,(1/A)(\partial G/\partial A) + D_1\,(\partial^2 G)/(\partial A^2)$. The diffusion constants D are calculated and it is found that $D_1 = D_2 = \frac{R^2(\langle\Theta^2(t)\rangle/t)}{4n}$, where $n = -(R/B)\partial B/\partial R$ is the usual magnetic field index and $\langle\Theta^2(t)\rangle$ is the mean-square multiple-scattering angle, projected on the vertical plane, accumulated during the time t. It is found that an equilibrium is established, after which $G(A,t)dA = \text{const} \times J_0\,[2.40\ A/(d-\Delta d)]\ \exp(-\lambda t)$, where J_0 is the zeroth-order Bessel function, and $\Delta d \sim 0.05d$ is a small correction to the effective dee aperture due to the divergence of the single Coulomb scattering cross section at zero scattering angle. The decay constant λ is given by $\lambda = 1.15\ (2.40)^2\ D_1/d^2$, where the factor 1.15 is a correction factor arising from single Coulomb scattering. Good agreement is found between the theoretical prediction for λ and the experimental values found during beam storage experiments by Crawford and Stubbins. (auth)

10601 UCRL-4461
California. Univ., Livermore. Radiation Lab.
EFFECT OF A DECELERATING GRID ON CURRENT FROM AN ION SOURCE. G. F. Bing, C. S. Gardner, and T. G. Northrop. Feb. 23, 1955. Decl. Aug. 15, 1956. 13p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40 (mf OTS).

A theoretical criterion is given for the conditions under which the ions from an ion source may be decelerated by a decelerating grid, following the accelerating grid which extracts ions from the emitter, without causing a reduction in the current supplied by the source. (auth)

10602
SOME PROBLEMS OF CONSTRUCTION AND DESIGN OF NUCLEAR PHYSICS ACCELERATION MECHANISM FOR PARTICLE ENERGIES OF SEVERAL MEV. K. Simonyi. Nuovo cimento (10) 3, Suppl. No. 3, 345-62(1956). (In German)

10603
TRENDS IN CYCLOTRON DESIGN. Robert S. Livingston (Oak Ridge National Lab., Tenn.). Ind. Eng. Chem. 48, 1231-7(1956) Aug.

Trends in the development of cyclotrons are briefly traced over the period since the machine was first proposed by E. O. Lawrence in 1930. Recent trends in design goals are better energy definition, the ready variability of beam energy, the acceleration of heavy particles, such as nitrogen, markedly increased beam currents, more dependable operation, and higher energies in the meson-producing range. These goals are being approached through such design features as improved beam deflectors and analyzers, larger power supplies and more flexible oscillators, improved ion sources, and the development of new magnetic field configurations to improve beam focusing and to provide phase adjustment for relativistic particles. It now appears possible to produce large currents of protons in the 1 Bev energy range with a fixed-frequency cyclotron having an azimuthally varying magnetic field. Such a machine now being studied at the Oak Ridge National Laboratory is briefly described. (ICE abst.)

10604
CYCLOTRON TARGET FOR THE IRRADIATION OF CHEMICAL COMPOUNDS. John A. Martin and Farno L. Green (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 1, 185-90(1956) May.

A capsule-type target is used with the ORNL 86-in. cyclotron for increased production rates of radioisotopes such as F^{18}, Sr^{85}, Y^{88}, I^{125}, and I^{130}. The target is economical for irradiation of materials which are scarce or expensive, e.g. enriched isotopes and rare earths, and materials which yield gaseous products. (auth)

10605
THE STUDY OF RELATIVISTIC PARTICLES BY THE USE OF NUCLEAR EMULSIONS IN A PULSED MAGNETIC FIELD. V. M. Likhachev, A. V. Kutsenko, and V. P. Boronkov (P. N. Lebedev Physical Inst., Academy of Sciences, U.S.S.R.). Soviet Phys. JETP 2, 766-7(1956) July. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 894-5(1955) Dec. (In Russian)

Nuclear emulsions were placed in a pulsed magnetic field and used to measure the photon spectrum from the synchrotron of the Physical Institute of the Academy of Sciences of the USSR. Preliminary data on the spectral distribution of resulting electron pairs are given in graphical form. (B.J.H.)

10606
SLOW LEAK TRITIUM SOURCE SUITABLE FOR A VAN DE GRAAFF GENERATOR. Denyse Magnac-Valette and M. Marcel Liess (Laboratoire de Physique Corpusculaire, Strasbourg). J. phys. radium 17, 449-50(1956) May. (In French)

10607
RECENT MODIFICATIONS TO THE 2-MEV VAN DE GRAAFF AT THE POLYTECHNICAL SCHOOL. Robert Barjon and Jean Schmouker (Ecole Polytechnique, Paris). J. phys. radium 17, 594-5(1956) July. (In French)

10608
PROBLEMS OF REGULATION AND CALIBRATION FOR A 31.8-MEV BETARON. G. Boulegue and P. Chanson (Laboratoires de Recherches de la D. E. F. A.). J. phys radium 17, 596-7(1956) July. (In French)

10609
A LINEAR ACCELERATOR FOR 2.3-MEV ELECTRONS. Th. Frelot, R. Combe, and M. Feix (College de France, Paris). J. phys. radium 17, 598-9(1956) July. (In French)

A travelling-wave accelerator is briefly described. The results obtained with the apparatus are presented. Some information about waveguide, microwave circuit, electron gun, and focusing coils is given. (auth)

10610
THE ELECTRON LINEAR ACCELERATOR OF THE C.E.N. AT SACLAY. E. Picard (Centre d'Études Nucléaires, Saclay). J. phys. radium 17, 600-1(1956) July. (In French)

The linear electron accelerator, which is being built at the Centre d'Études Nucléaires of Saclay, is briefly described. The main characteristics of the beam are a mean current 85 μa for an energy of 28 Mev, and a duty cycle of $^1/_{1,000}$. The beam, when falling on a uranium target, creates a mean flux of 10^{13} neutrons per second. An accurate magnetic deflection provides a monochromatic electron beam, the relative spread of which will be of the order of 10^{-3}. The experimental facilities are described. (auth)

RADIATION ABSORPTION AND SCATTERING

10611
RANGE-ENERGY RELATIONS OF $3 \leq Z \leq 10$ IONS IN ILFORD C_2 NUCLEAR EMULSIONS. Andre Papineau. Compt. rend. 242, 2933-6(1956) June 18. (In French)

Using the experimental results concerning the charge states of N, O, and Ne ions as a function of their speed, it was possible to calculate the range-energy relationships of ions with $3 \leq Z \leq 10$ from those for α particles. The calculations are in good agreement with the known experimental points. It is possible to deduce certain data on the charge states of heavy ions from them. (tr-auth)

10612
MODES OF REACTIONS OF 0.95-BEV PROTONS WITH LIGHT AND HEAVY NUCLEI IN PHOTOGRAPHIC EMULSIONS. Georges Philbert. Compt. rend. 243, 141-3(1956) July 9. (In French)

Comparison of the results obtained in the scanning of normal and diluted emulsions exposed to a beam of 0.95-Bev protons allows the calculation of the partial probabilities of reactions with the emission of n charged particles. The variation of this probability as a function of n is very different for the heavy nuclei (Br, Ag) and the light nuclei (C, N, O). (tr-auth)

10613
GAMMA-RAY SCATTERING FROM THIN SCATTERERS. David G. Chappell. (Knolls Atomic Power Lab., Schenectady, N. Y.). Nucleonics 14, No. 7, 36-7(1956) July.

Nomograms are presented which permit rapid estimation of photon flux reflected from a thin object. (auth)

10614
ON THE WIDENING OF AN X-RAY BEAM ON TRAVERSING A HETEROGENEOUS MATERIAL. M. Lambert and A. Guinier (Conservatoire National des Arts et Metiers, Paris). J. phys. radium 17, 420-5(1956) May. (In French)

A very narrow x-ray beam traversing a thick sample of fine particles undergoes a widening which is due to the low-angle multiple scattering. From the variation of the beam width with screen thickness one can deduce the particle dimensions. The phenomenon was observed with various pulverized products. On the other hand, the observations of Rovinsky and Genkin on the widening of beams through metallic foils (Al, Cu) were not confirmed. (tr-auth)

10615
RANGE-ENERGY RELATIONS OF HEAVY IONS IN NUCLEAR EMULSIONS. A. Papineau (Service de Physique Nucléaire, Saclay). J. phys. radium 17, 566-7(1956) July. (In French)

Calculations were made of the range-energy relations for heavy ions from lithium to neon, in nuclear emulsions, using the experimental curve for protons and the known experimental determinations of the state of ionization of nitrogen, oxygen and neon ions vs energy. Some extrapolations have been made for the probability of stripping of the last K electron. Curves so obtained are in good agreement with experimental points known for Li^8, B^8, C^{12}, N^{14}. (auth)

10616
α PARTICLE ABSORPTION IN MATTER STUDIED BY MAGNETIC DEVIATION. Jeanine Blandin-Vial (Attachee de Recherches au Laboratoire de l'Aimant-Permanent, Bellevue). J. phys. radium 17, 568-70(1956) July. (In French)

10617
CONTRIBUTION OF THE NUCLEAR ELECTRIC FIELD TO THE ELASTIC SCATTERING OF 1.33-MEV AND 2.62-MEV γ RAYS. Philippe Eberhard, Lazare Goldzahl, Eiichi Hara, and Jacques Mey (College de France, Paris). J. phys. radium 17, 573-5(1956) July. (In French)

A study was made of the contribution of the nuclear electric field to the elastic scattering of 1.33- and 2.62-Mev gamma rays. If it is assumed that the calculations of Rayleigh's scattering by the atom's bound electrons are even approximately correct, the measurements establish evidence of this contribution. (auth)

10618
POLARIZATION OF NUCLEONS FROM PHOTONUCLEAR REACTIONS. W. Czyz (Jagiellonian Univ., Kraków, Poland) and J. Sawicki (Univ. of Warsaw, Poland). Nuovo cimento (10) 3, 864-9(1956) May.

A method is given to calculate the polarization of nucleons produced in photonuclear reactions if the photonucleon is assumed to interact with the residual nucleus through a potential containing in general a spin-orbit coupling. The method is applied to the $Be^9(\gamma,n)Be^8$ reaction where for the Be^9 nucleus the one particle model is assumed with the central interactions of Guth and Mullin. The maximum polarization $P_{max} \sim 45\%$ results for $\hbar\omega = 2$ Mev at the scattering angle $\theta \sim 45°$. The dependence of P on θ is shown graphically for some energies $\hbar\omega$ near the threshold of the reaction. The polarization of photonucleons from a nucleus being in a $S_{1/2}$ ground state is discussed. Further applications of the method and the results are indicated. (auth)

10619
PENETRATION OF GAMMA RADIATION FROM A PLANE MONODIRECTIONAL OBLIQUE SOURCE. Martin J. Berger. J. Research Natl. Bur. Standards 56, 111-28(1956) Mar.

The penetration of gamma radiation from a plane monodirectional oblique source is solved by the moment method of Spencer and Fano. The novel feature of the treatment is the systematic investigation and exploitation of a function-fitting technique, which consists of approximating the desired radiation-flux function, $f(x)$, by an expression of the form $\sum_n A_n \phi(B_n x)$, the parameters A_n and B_n being determined from the knowledge of the flux moments. A discussion is given of the criteria for the proper choice of the "weight function," $\phi(x)$, and of the accuracy of the fitting procedure. The results of a sample calculation are presented for an 0.66-Mev source in water. (auth)

10620
ENERGY AND ANGLE DISTRIBUTION OF ELECTRONS IN BREMSSTRAHLUNG. P. T. McCormick, D. G. Keiffer, and

G. Parzen (Univ. of Notre Dame, Ind.). Phys. Rev. 103, 29-31(1956) July 1.

The cross section $\sigma(E,\alpha)$ for an electron of incident energy E_0 to radiate in the presence of a nucleus with atomic number Z and to come out with energy E, at the angle α has been recalculated, checking the result of Racah. $\sigma(E,\alpha)$ has been tabulated for various outgoing energies and angles of the electron corresponding to incident momenta of 2mc, 4mc, 6mc, 10mc and 20mc. For the case of large α, and large incident and final energies, $\sigma(E,\alpha)$ may be represented by a simple expression and the coefficients in this expression have been tabulated. This paper also collects the various formulas which are involved in this particular aspect of bremsstrahlung and which do not seem to be conveniently available in the literature. (auth)

10621

ELASTIC SCATTERING OF PROTONS FROM B^{11} AND N^{14}. George W. Tautfest and Sylvan Rubin (Stanford Research Inst., Menlo Park, Calif.). Phys. Rev. 103, 196-9(1956) July 1.

The absolute differential cross sections for the elastic scattering of protons by B^{11} and N^{14} have been measured with a probable error of 7%. The cross section for $B^{11}(p,p)$ was measured at a center-of-mass angle of 152° 36′ for proton energies from 600 to 2000 kev. A marked scattering anomaly is observed at a proton energy of 675 (2^-) kev. The cross section for $N^{14}(p,p)$ was measured at a center-of-mass angle of 152° for proton energies from 850 to 1900 kev. Scattering anomalies were observed at proton energies 1.060 ($\frac{1}{2}^+$), 1.555 ($\frac{1}{2}^+$), 1.740 ($\frac{3}{2}^-$ or $\frac{5}{2}^-$) and 1.803 ($\frac{3}{2}^-$ or $\frac{5}{2}^-$) Mev. The indicated spin and parity assignments for the corresponding levels in the compound nucleus are consistent with the results of this experiment. The off-resonance cross sections exhibit marked variations from the Rutherford cross sections over the entire range of energies studied. (auth)

10622

TOTAL p-p AND "p-n" CROSS SECTIONS AT COSMOTRON ENERGIES. Francis F. Chen and Christopher P. Leavitt (Brookhaven National Lab., Upton, N. Y.) and Anatole M. Shapiro (Brookhaven National Lab. and Harvard Univ., Cambridge, Mass.). Phys. Rev. 103, 211-25(1956) July 1.

The total proton-proton cross section (excluding Coulomb scattering) has been measured at energies from 410 Mev up to 2.6 Bev, using external beams from the Cosmotron. Fast counting equipment was used to measure the attenuation of the beams through polyethylene, carbon, and liquid H_2 absorbers. At each energy E, $\sigma_{p\text{-}p}(E,\Omega)$ was measured as a function of the solid angle Ω subtended by the rear counter at the center of the absorber. The total cross section $\sigma_{p\text{-}p}$ was obtained by a least squares straight line extrapolation to $\Omega = 0$. The measured $\sigma_{p\text{-}p}$ as a function of energy rises sharply from 26.5 mb at 410 Mev to 47.8 mb at 830 Mev and then remains approximately constant out to 1.4 Bev, above which energy it decreases gradually to about 42 mb at 2.6 Bev. Using the same equipment and procedure, measurements were made of the D_2O-H_2O difference cross section, called "$\sigma_{p\text{-}n}$," for protons over the same energy range. From a comparison of "$\sigma_{p\text{-}n}$," and $\sigma_{p\text{-}p}$, with the n-p and n-d measurements of Coor et al. at 1.4 Bev, it is apparent that one nucleon is "shielded" by the other in the deuteron. This effect is not present at energies below 410 Mev. Comparing the measured p-p and "p-n" (corrected) cross sections with the results of other high-energy experiments, one may infer the following conclusions: (1) The sharp rise in $\sigma_{p\text{-}p}$ from 400 to 800 Mev results from increasing single pion production, which may proceed through the $T = \frac{3}{2}$, $J = \frac{3}{2}$ excited nucleon state. (2) Above 1 Bev the inelastic (meson production) p-p cross section appears to be approximately saturated at 27 to 29 mb. (3) The rise in cross section for n-p interaction in the T = 0 state, associated with the rise in double pion production, implies that double meson production also proceeds through the $T = \frac{3}{2}$ nucleon state. (4) The probable equality of $\sigma_{p\text{-}d}$ and $\sigma_{n\text{-}d}$ at 1.4 Bev implies the validity of charge symmetry at this energy. (auth)

10623

Z DEPENDENCE OF BREMSSTRAHLUNG FOR THE CASE OF COMPLETE SCREENING. Karl L. Brown (Stanford Univ., Calif.). Phys. Rev. 103, 243-6(1956) July 1.

The relative yield of 235-Mev photons from the elements Cu, Ta, and U for incident electrons of energy 500 Mev has been measured by using the photoproduction of positive pions from liquid hydrogen as an essentially monoenergetic photon detector. The observed photon yield per radiation length of U relative to Cu is 0.878 ± 0.02, and of Ta relative to Cu is 0.937 ± 0.015. These results are consistent with the predictions of a theorem of Olsen which evaluates the integral bremsstrahlung cross section in terms of the integral pair-production cross section of Bethe, Maximon, and Davies. (auth)

10624

RANGE-ENERGY RELATION FOR LOW-ENERGY ALPHA PARTICLES IN Si, Ge, AND InSb. G. W. Gobeli (Purdue Univ., Lafayette, Ind.). Phys. Rev. 103, 275-8(1956) July 15.

The range-energy relations for alpha particles in Ge, Si, InSb, Al, Cu, Ag, and Au were determined by measuring the air equivalents of thin foils of the materials. The incident alpha particles had energies between 0.7 Mev and 4.45 Mev and were obtained from a Po^{210} source with air as a variable absorber. A CsI(Tl) crystal was employed as the detector, and the pulse-height distributions of the alpha particles were observed with a 20-channel pulse-height analyzer. Approximate analytical expressions for the ranges in microns in Si, Ge, and InSb for alpha-particle energies above 0.5 Mev are: $R_{Si} = 2.13E^{1.45} + 2.20$, $R_{Ge} = 1.95E^{1.34} + 1.72$, and $R_{InSb} = 2.08E^{1.39} + 1.65$. The ranges for the semiconductors interpolate smoothly between those of the metals, which are in good agreement with available data. (auth)

10625

PENETRATION OF ELECTRONS IN ALUMINUM OXIDE FILMS. J. R. Young (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev. 103, 292-3(1956) July 15.

The practical range of low-energy electrons in thin Al_2O_3 films has been measured. Films ranging in thickness from 85 to 5000 A were investigated. Results are in close agreement with the predictions of Bethe and the results obtained by Hoffman for 1000 to 3000 A Al_2O_3 films. The practical range-energy relation obtained was found to be $R = 0.0115E^{1.35}$, where R is expressed in mg/cm^2 and E in kev. (auth)

10626

RELATION BETWEEN THE VIBRATION FREQUENCIES OF A CRYSTAL AND THE SCATTERING OF SLOW NEUTRONS. G. L. Squires (Institute for Advanced Study, Princeton, N. J.). Phys. Rev. 103, 304-12(1956) July 15.

Detailed calculations of the scattering of slow neutrons by crystals have so far been made on the basis of the Debye approximation for the vibration frequencies of the crystal. In the present work, a somewhat more realistic set of frequencies has been calculated for the case of aluminum. The results have been used to calculate the angular and energy distribution of neutrons coherently scattered in a one-phonon process. Comparison is made with the results given by the Debye approximation. The

distribution function of the calculated frequencies has been used to obtain values for the Debye-Waller factor and for the total incoherent cross section for incident neutrons with long wavelengths. (auth)

10627

NEUTRON SCATTERING AT 2.45 MEV BY A TIME-OF-FLIGHT METHOD. Lawrence Cranberg and Jules S. Levin (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 103, 343-52(1956) July 15.

Results have been obtained by a pulsed-beam time-of-flight method for the cross sections for excitation of various levels in many nuclides by inelastic scattering at 90 degrees. The incident neutrons had a mean energy of 2.45 Mev and a spread of plus and minus 100 kev. Detailed angular distributions are given for the neutrons of inelastic scattering, for the accompanying de-excitation gamma rays, and for the elastically scattered neutrons for iron, nickel, and titanium. Such results are also given for iron and titanium for a mean incident energy of 2.25 Mev. The angular distributions indicate that for these nuclides and excitations the statistical assumption is not applicable to states in the compound nucleus. Results on the spectrum of neutrons inelastically scattered by gold may be fitted over a limited range by an effective nuclear temperature of 0.3 ± 0.03 Mev. The same temperature describes the data on uranium 238 after substraction of a fission neutron spectrum. (auth)

10628

DIFFUSION OF CHARGED PARTICLES ACROSS A MAGNETIC FIELD. C. L. Longmire and M. N. Rosenbluth (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 103, 507-10(1956) Aug. 1.

The diffusion of charged particles across a magnetic field was studied, treating collision-induced steps of the guiding centers as a random walk process. Particular attention is paid to the vanishing of the first-order flux due to like-particle collisions. (auth)

10629

DENSITY EFFECT FOR THE IONIZATION LOSS IN VARIOUS MATERIALS. R. M. Sternheimer (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 103, 511-15 (1956) Aug. 1.

The reduction in the ionization loss of charged particles due to the polarization of the medium has been calculated using the mean excitation potentials recently determined by Caldwell. Values of the coefficients of an approximate analytic expression for the density effect correction have been obtained for a number of metals, compounds, and gases. (auth)

10630

X-RAY COMPTON SCATTERING FOR ALUMINUM. C. B. Walker (Univ. of Chicago). Phys. Rev. 103, 558-61(1956) Aug. 1.

The intensity of the Compton scattering of x rays by Al has been measured for values of $\sin\theta/\lambda$ from 0.3 to 0.6 A^{-1}. The method involved a self-consistent separation into the Compton and thermal diffuse scattering of the total intensities of diffuse scattering measured at 300 and 5°K. The measured Compton scattering is significantly lower than the intensity calculated theoretically. Limitations of the present theories are discussed. (auth)

10631

PERTURBATION CALCULATION OF THE INELASTIC SCATTERING OF ELECTRONS BY HYDROGEN ATOMS. Sidney Borowitz and Milton M. Klein (New York Univ., N. Y.). Phys. Rev. 103, 612-19(1956) Aug. 1.

A perturbation calculation has been made of the inelastic scattering of fast electrons by H atoms to the 2S and 2P states, using for the perturbation only the interaction between the incident electron and the bound electron. The results are then compared, to leading order terms in the energy, with calculations by the more customary perturbation scheme. For direct scattering, the results for forward scattering amplitudes are identical using either procedure. The angular distribution and energy dependence are different. For exchange scattering, the symmetric and asymmetric perturbations give different results both in the forward direction and at angles other than zero. However, in the former scheme exchange scattering is negligible compared to the direct scattering. The calculations for direct scattering are shown to be simplified by using a somewhat different perturbation scheme (method of altered states). (auth)

10632

ELASTIC SCATTERING OF NITROGEN BY NITROGEN. C. E. Porter (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 103, 674-5(1956) Aug. 1.

The differential cross section for the elastic scattering of N by N is calculated approximately by using a classical model which has been found previously to account for the elastic scattering of alpha particles by heavy nuclei. The effective mean free path in the collision process is found to be 15 to 35 times smaller than the interaction radius (twice the radius of a single N nucleus), indicating an extremely strong interaction when two "chunks" of nuclear matter collide. (auth)

10633

NEUTRON SCATTERING FROM IRON AND CARBON BY TIME-OF-FLIGHT. C. O. Muehlhause, S. D. Bloom, H. E. Wegner, and G. N. Glasoe (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 103, 720-6(1956) Aug. 1.

A fixed-frequency cyclotron in conjunction with mμ sec time-of-flight techniques has been used to study elastic and inelastic neutron scattering from Fe and C in the Mev range. The elastic angular distribution from Fe exhibits an optical diffraction type pattern, and the inelastic angular distribution proves to be primarily isotropic except for a slight asymmetry around 90 degrees. The elastic angular distribution from C is in essential agreement with previous work. (auth)

10634

VACUUM POLARIZATION AND PROTON-PROTON SCATTERING IN THE ^3P STATE. Erik Eriksen (Univ. of Oslo, Blindern, Norway) and Leslie L. Foldy and William Rarita (Case Inst. of Tech., Cleveland). Phys. Rev. 103, 781-3(1956) Aug. 1.

The contribution of the vacuum polarization potential to the ^3P phase shift in p-p scattering has been calculated and employed to correct observed phase shifts to obtain the phase shifts associated with the specifically nuclear ^3P potential between two protons. In the energy range from 2 to 5 Mev, about half the observed phase shift can be attributed to vacuum polarization. From the results it is shown that if the potential between the two protons in both the ^1S and ^3P states is represented by a square well of range 2.6×10^{-13} cm, then the ^3P potential is opposite in sign (repulsive) and approximately 13% in magnitude relative to the ^1S potential. (auth)

10635

BORN APPROXIMATION IN A THREE-BODY SCATTERING PROBLEM. S. L. Schwebel (Lockheed Aircraft Corp., Van Nuys, Calif.). Phys. Rev. 103, 814-21(1956) Aug. 1.

A one-dimensional three-body scattering problem is constructed and solved exactly. The scattering amplitudes of the exact solution are compared with those obtained by the application of the Born approximation to the problem. The latter procedure is formulated in two distinct ways, using a symmetric or asymmetric perturbation term. The results

indicate that the method using symmetric perturbation is superior to that employing asymmetric perturbation, although it is more difficult mathematically. An approximation method is developed which yields results as accurate as those obtained from the symmetric perturbation and which is on the same mathematical plane of difficulty as the asymmetric perturbation scheme. Moreover, the procedure is applicable to actual physical problems and is particularly useful for the calculation of exchange scattering. (auth)

Refer also to abstracts 10362, 10363, 10467, 10472, and 10473.

RADIATION EFFECTS

10636 ACR-2
Naval Research Lab., Washington, D. C.
CONFERENCE ON EFFECTS OF RADIATION ON DIELECTRIC MATERIALS, NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., DECEMBER 14-15, 1954. 173p.

Papers are presented on radiation, polymer chemistry, and the effects of radiation on polymers, polymerization, crystals (single crystals of alkali halides), glass, various organic materials, and metal oxides. The papers are largely general and some are reviews. A 217 item bibliography on radiation effects on high polymers is included. (T.R.H.)

10637 AERE-R/M-22
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
RADIATION DAMAGE STUDIES WITH REFERENCE TO CYCLOTRON IRRADIATIONS. G. H. Kinchin. June 30, 1953. 8p.

The theory of radiation damage by displacement production is outlined. A brief review of the experimental field is given and the values of different types of radiation are compared. It is indicated that a small cyclotron would be very valuable for irradiation experiments. (auth)

10638 NRL-4807
Naval Research Lab., Washington, D. C.
THE DISORDERING OF POLYATOMIC SOLIDS BY NEUTRONS. E. G. Harris. July 6, 1956. 11p. Project No. NR-665-010.

A general method is outlined for calculating the number of vacant lattice sites or interstitial atoms produced in a polyatomic solid by neutron radiation. It is assumed that the colliding atoms are in the energy range for which the orbital picture is valid and are of sufficiently low energy for no appreciable fraction of their energy loss to occur in inelastic collisions. It is found that for energies much greater than the binding energies of the atoms in the lattice, the number of displaced atoms is a linear function of the neutron energy. The fraction of the energy of an incident neutron used in the production of displacements is found to be approximately one-half and to be very insensitive to the composition of the solid. If the energy required to displace an atom is the same for the atomic species in the solid, then equal numbers of each species are displaced. The theory is also extended to include charged particle radiation. (auth)

10639
ATOMIC MOBILITY IN A Cu–Al ALLOY AFTER QUENCHING AND NEUTRON IRRADIATION. Chi Yao Li and A. S. Nowick (Yale Univ., New Haven, Conn.). Phys. Rev. 103, 294-303(1956) July 15.

A study of atomic mobility in a Cu–Al (17 atomic percent Al) solid solution is carried out by anelastic relaxation methods. Measurements are made under equilibrium conditions, after quenching, and after neutron irradiation. The results differ significantly in two ways from the quenching experiments of Kauffman and Koehler on pure gold. First, the ratio J/Q (where J is the activation energy for migration of the appropriate lattice defect, and Q the activation energy for equilibrium atomic diffusion) is 0.6 in the present experiments and only 0.36 for the quenched gold. This difference in ratio corresponds to a difference of about two orders of magnitude in the vacancy concentration at the melting point. Second, in contrast to the behavior of the pure metal, the irradiated Cu–Al alloy shows no evidence for the annealing of point defects in the range of temperature in which quenching effects anneal out. It is therefore difficult to reconcile the present results with those on pure gold if one assumes that the same lattice defect is responsible for both. A survey of other quenching experiments and of measurements on the annealing of cold worked metals provides additional evidence for a defect for which J/Q = 0.5 to 0.6 in various metals. A tentative interpretation of existing data may be given in terms of the assumption that the low-mobility (high J/Q) defect is the single vacancy while the high-mobility defect is the di-vacancy. (auth)

10640
RADIATION DAMAGE TO THE ELECTRICAL CONDUCTIVITIES OF NATURAL GRAPHITE CRYSTALS. W. Primak and L. H. Fuchs (Argonne National Lab., Lemont, Ill.). Phys. Rev. 103, 541-4(1956) Aug. 1.

When natural graphite crystals were exposed in nuclear reactors, it was found that the α-axis electrical conductivity decreased progressively and monotonically, eventually about twenty-fold. The c-axis electrical conductivity decreased by a factor of about three to a minimum and then slowly increased somewhat. Very early in the irradiation, the temperature dependence of the conductivities altered to a negligible dependence on temperature, indicating the spacing of fixed scattering centers in the original crystals was at least hundreds of atomic spacings. The approximate values of the crystallite conductivities in artificial graphite are inferred from the results obtained for the natural graphite crystals. (auth)

10641
WHAT ARE EFFECTS OF RADIATION ON ELECTRONIC COMPONENTS? Nucleonics 14, No. 7, 33-5(1956) July.

Phototubes, bias cells, and dry rectifiers may fail to operate in intense fields of neutrons and gammas. But sensitive circuits made of selected components will function normally. (auth)

10642
ELECTRON BOMBARDMENT OF COUNTING DIAMONDS. K. Stratton (Royal Free Hospital School of Medicine, London) and G. W. Dolphin (Medical Coll. of St. Bartholomew's Hospital, London). Nature 178, 208(1956) July 28.

RADIOACTIVITY

10643 AERE-RP/M-38
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE POSSIBILITY AND DETECTION OF A METASTABLE STATE IN THE $U^{239}-Pu^{239}$ AND $Th^{233}-U^{233}$ SERIES. V. S. Crocker. Sept. 1, 1954. 7p.

The possibility of long lived metastable states in the U^{239} and Th^{233} series is discussed, and experiments, which could detect these states, are suggested. From the present data, it is thought that a metastable state in U^{239} must either be of almost negligible abundance or exceedingly long half life ($>10^4$ yr). For the other isotopes in the

series, the accepted decay schemes have to be relied upon, and any long lived metastable states might have been overlooked. (auth)

10644

DECAY OF THE CERIUM-139 ISOMERS. B. H. Ketelle, H. Thomas, and A. R. Brosi (Oak Ridge National Lab., Tenn.). Phys. Rev. 103, 190-5(1956) July 1.

The decay of the 140-day ground state of Ce^{139} has been reinvestigated. A 4π scintillation spectrometer has been used to show that K-electron capture transitions between ground states are less than one percent of all K-electron captures. The same instrument has been used to measure the fraction of all transitions which terminate at the 166-kev level due to K-electron capture, and also has been used to determine the conversion coefficient of the 166-kev transition. The K-conversion coefficient was found to be 0.22 ± 0.01. K-electron capture accounts for 73% of all transitions to the 166-kev level. The energy available for decay to the excited levels is 104 ± 6 kev as computed from the experimental capture ratio. A value of 0.88 ± 0.01 was obtained for the K-fluorescence yield at Z of 57 from beta-ray spectrometer measurements and coincidence counting. An isomeric level of 740 ± 5 kev above the ground state of Ce^{139} has been found. The half-life of the transition is 55 ± 3 sec and its K-conversion coefficient is 0.08 ± 0.02. Mass and element assignments have been established and approximate cross sections for activation of each level in Ce^{139} by the (n,γ) reaction on Ce^{138} in the graphite reactor have been determined. (auth)

10645

DECAY OF Co^{58}. H. Frauenfelder, N. Levine, A. Rossi, and Sidney Singer (Univ. of Illinois, Urbana). Phys. Rev. 103, 352-5(1956) July 15.

Co^{58} decays not only to the first but also the second excited state of Fe^{58}. Both of these states in Fe^{58} possess spin 2, even parity, and the transition between them is a mixture of E2 and M1, with a mixing ratio $\delta(E2/M1) = +2.2 \pm 0.3$. The intensities of the 1.62-Mev and 0.81-Mev gamma rays originating from the second excited state (relative to the main 0.81-Mev transition) are 0.005 ± 0.001 and 0.016 ± 0.005, respectively. (auth)

10646

GAMMA RADIATION IN RaD AND RaE DECAY. R. W. Fink, G. W. Warren, R. R. Edwards, and P. E. Damon (Univ. of Arkansas, Fayetteville). Phys. Rev. 103, 651-5 (1956) Aug. 1.

By using chromatographically separated, carrier-free sources, the electromagnetic spectra of RaD and RaE have been investigated from 4 to 60 kev with an argon-methane gas proportional spectrometer. No gamma rays or L x-rays were detected in the decay of RaE. Aside from the principal 46.5-kev transition, no gamma rays (<0.2% of the 46.5-kev photons) were observed in the decay of freshly-purified RaD. However, when equilibrium mixtures of RaDEF, from spent radon seeds less than 2 years old, were examined through aluminum absorbers of thickness sufficient to eliminate pile-up peaks (20 to 26 kev) from the L x-rays (10 to 16 kev), a broad peak at about 31 kev appeared; ed; it was established conclusively that in reality this is external beta-bremsstrahlung of RaE, whose low-energy region has been attenuated selectively so as to give the appearance of a gamma-ray peak. A chromatographic column separation of millicurie quantities of carrier-free RaD and RaE from each other, as well as from RaF and macro amounts of gold and mercury impurities, is described. The time required for separation is less than 2 hours. (auth)

10647

THE FORBIDDEN β SPECTRA FOR Rb^{86}, Sr^{90}, Y^{90}, and Tl^{204}. E. E. Berlovich, D. M. Khaĭ, and A. V. Savateev (Leningrad Physico-Technical Inst.). Izvest. Akad. Nauk. S.S.S.R. Ser. Fiz. 20, 275-88(1956) Mar. (In Russian)

Experiments were made with a sector-type scintillation spectrometer with high resolving power and improved focusing. To reduce a possible scattering of electrons from the chamber walls, the large angles in the spectrometer were reduced by placing additional diaphragms in the path of the beam in the source chamber, deflection chamber, and counter chamber. The decay scheme of $Rb^{86} \rightarrow Sr^{86}$ and Curie graphs for Rb^{86} β spectra are given. To check the presence of Sr impurities in Rb, γ radiation of 6-months-old Rb was investigated. The results of β-spectra measurements for $Sr^{90} + Y^{90}$ are presented on Curie coordinates. Curie graphs for β spectra of Sr^{90} and Tl^{204}, the amplitude spectra of Tl^{203} electromagnetic radiation diagram, and the results of the spectrometric studies of the Tl^{204} nucleus are given. (R.V.J.)

10648

ON THE RADIATION OF Sb^{124}. A. V. Zolotavin, E. P. Grigor'ev, and M. A. Abroyan (Zhadanov Leningrad State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 289-307 (1956) Mar. (In Russian)

A double-focusing β spectrometer 14 cm. in diameter with solid angle of 0.65% of the total solid angle, and magnetic field focusing flat electron beam was used in investigation of Sb^{124} radiation. The Sb^{124} β spectrum was studied on several sources with 5 ÷ 500 μg cm^{-2} surface density and layers of collodium and Al of 50 ÷ 1500 μg cm^{-2}. The solid spectra were derived by comparison of data obtained from sources of 5, 50, 100 and 500 μg cm^{-2} in thickness. Curves of Sb^{124} β spectrum in Hρ coordinates up to 4000 Gs cm and 4000 to 9300 Gs cm are presented. Curie graphs for Sb^{124} β spectra hard component and component analysis are developed. To determine the probability of Sb^{124} β decay in transition to the basic Te^{124}, the spectrum was measured from strong source 3mCu and the result showed the sought-for probability to be less than 10^{-5}. Conversion lines for γ transitions with $h\nu = 714$ and 723 kev and $h\nu = 1693$ kev, and Sb^{124} conversion line relative intensities are tabulated. The photoelectron spectrum of Sb^{124} γ transitions ($h\nu = 1298$ to 1370 kev) was studied. Curves are given for photoelectrons with Th(3 mg cm^{-2}) target for γ rays with $h\nu = 970$ and 1047 kev. Photoelectron spectra of the 5200 to 5790 Gs cm area from Th(3 mg cm^{-2}) and Pb(18 mg cm^{-2}) targets are given. The spectrum of electron recoil was studied separately. Conversion coefficients and multiplicity of γ transitions are analyzed. (R.V.J.)

10649

ANALYSIS OF β-SPECTRUM FORM FOR RaE. L. N. Zyryanova (Zhdanov Leningrad State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 308-11(1956) Mar. (In Russian)

The new measurements of RaE spin indicate that the β transition of RaE (Bi^{210}_{83}) → Po^{210}_{83} belongs to the type of $-1 \rightarrow +0$ i.e., that the RaE β spectrum is first-forbiden, with spin change of $\Delta J = 1$. In contrast to the other first-forbidden β spectra and "resolved" form, the RaE β spectrum cannot be described by the Fermi expression. The theoretical forms of RaE spectra are compared with experimental data. The assumptions of various proton distributions in the nucleus and various nuclear radii are discussed. (R.V.J.)

10650

POSITRONS OF INTERNAL CONVERSION IN RADIOACTIVE ISOTOPE Sb^{124}. B. S. Dzhelepov and O. E. Kraft (Zhdanov Leningrad State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 318-27(1956) Mar. (In Russian)

An improved β spectrometer with triple-beam focusing was designed for the investigation of β-radiation weak components of particular type on the background of intensive

radiation of particles of different type. In the new spectrometer the counters were placed in a chamber separated from the apparatus by 8 to 10μ thick cellophane layers, 5×10^{-2} mm Hg vacuum was created in the apparatus. Correct shapes of electron spectra were obtained only at high energies (> 600 kev). The shape distortions were due to the electron scattering on the layer of the first counter. During the experiments with Sb^{124} the distortions did not exceed 5% in the energy range of 600 kev. Measurements of the counting rate of coincidences in "electron" and "positron" fields were made with P^{32} as source. It has been observed that with small "positron" fields the number of coincidences is reduced with the increase of the field. Calculations of impulses registered by first and second counters and the resolving time of the amplifier ($\tau = 8 \times 10^{-6}$ sec) produced the number of accidental coincidences in any magnetic field which also showed that the number of coincidences is reduced with the expansion of fields. The number of positrons in P^{32} decay was less than 1×10^{-7}; for sources similar to P^{32} and without γ-ray emissions, the number of electrons, scattered in fields of reverse sign was less than 1×10^{-7}. For Ir^{192} the measurements of the number of coincidences in positron fields gave an upper limit for the number of positrons or scattered electrons as 1×10^{-6}. Positrons of internal conversion with pair formation and the coefficient of the internal pair conversion was determined for Sb^{124}. (R.V.J.)

10651

A NOTE ON THE DECAY OF ^{185}W. S. K. Bhattacherjee and Shree Raman (Tata Inst. of Fundamental Research, Bombay). Nuovo cimento (10) 3, 1131-2(1956) May.

β-γ coincidence measurements on W^{185} confirmed the decay scheme previously proposed by A. Bisi. (D.E.B.)

10652

THE CONVERSION LENGTH OF HIGH ENERGY PHOTONS. K. Pinkau (Univ. of Bristol, England). Nuovo cimento (10) 3, 1156-8(1956) May.

An examination of high energy electromagnetic cascades initiated by single photons indicates a conversion length of 4.3 cm., in fairly good agreement with theoretical values. (D.E.B.)

10653

GAMMA-GAMMA ANGULAR CORRELATION IN ^{160}Dy. G. Bertolini, M. Bettoni, and E. Lazzarini (Istituto di Fisica Sperimentale del Politecnico, Milan). Nuovo cimento (10) 3, 1162-5(1956) May.

The method and results of γ-γ angular correlation measurements on Dy^{160} are given. Angular efficiency and angular correlation plots were prepared. (D.E.B.)

10654

DECAY OF Gd^{153}. S. K. Bhattacherjee and Shree Raman (Tata Inst. of Fundamental Research, Bombay). Nuclear Phys. 1, 486-98(1956) June.

The decay by electron capture of Gd^{153} (half life 236 days) is studied with a coincidence scintillation spectrometer. Two γ rays are observed with energies 72 ± 8 kev and 100 ± 4 kev and relative intensities of 7:100. Both these γ rays are coincident with K x rays of Eu. From the coincidence data the K-shell conversion ciefficient of the 100-kev γ transition has been determined to be 0.67 ± 0.12; the comparison with theory then leads to assigning this γ-ray predominantly to a magnetic dipole transition. From the experimental L/K capture ratio the energy involved in the capture process is estimated. Our results show that the levels in Eu^{153} which are reached by the capture decay of Gd^{153} are not identical with the levels that were observed in coulomb excitation of Eu. On the basis of our findings we propose a decay scheme for Gd^{153}. (auth)

10655

γ-RAYS FROM THE DECAY OF Zr^{97}. R. Nordhagen and J. Thomassen (Univ. of Oslo, Blindern, Norway). Nuclear Phys. 1, 499-500(1956) June.

Gamma rays of Zr^{97}, not previously known, were studied with the help of a 100-channel scintillation counter γ spectrometer. A NaI(Tl) crystal was used as a counter. (F.S.)

10656

MEASUREMENT OF THE HALF LIFE OF RaE (Bi^{210}). J. Robert and J. Tobailem (Institut du Radium, Paris). J. phys. radium 17, 440-1(1956) May. (In French)

Precise measurements were made of the half life of the decay of RaE by means of two ionization chambers. A value of T = 5.013 ± 0.005 days was obtained. (tr-auth)

10657

ON THE LONG RANGE PARTICLES EMITTED BY THE RADIOELEMENTS. Marie Ader (College de France, Paris). J. phys. radium 17, 451-2(1956) May. (In French)

10658

THEORETICAL STUDY OF THE β SPECTRUM OF RaE. Roger Nataf (College de France, Paris). J. phys. radium 17, 480-91(1956) June. (In French)

10659

ON A 121-KEV γ RAY OBSERVED IN A VERY PURE SOURCE OF Pm^{147}. Hèlène Langevin-Joliot (College de France, Paris) and Michael Lederer (Institut du Radium, Paris). J. phys. radium 17, 497-8(1956) June. (In French)

10660

SOME DATA ON THE RADIOACTIVE TRANSFORMATION Tb^{161}(7 DAYS) — Dy^{161}. René Ballini and Roland Barloutaud (C.E.N., Saclay). J. phys. radium 17, 498-9(1956) June. (In French)

10661

THE EFFECT OF K CAPTURE OF ANGULAR CORRELATIONS. P. Lehmann and J. Miller (Service de Physique Nucléaire, Saclay). J. phys. radium 17, 526-7(1956) July. (In French)

The differential anisotropy of the angular correlation of the γ cascade 170 kev—250 kev from In^{111} has been measured using ionic and metallic polycrystalline sources. With a metallic source, the variation A(t) expected from a static electric quadrupole interaction is found. In the ionic sources, fluctuating fields resulting from the K capture are present. (auth)

10662

LONG RANGE PARTICLES EMITTED BY NATURAL α RADIOELEMENTS. Marie Ader (College de France, Paris). J. phys. radium 17, 541-4(1956) July. (In French)

Particles with an unusually long range are emitted by polonium and plutonium 239 sources, as well as by thorium and actinium active deposits. The maximum range appears to be approximately the same for all the elements studied, and is greater than 300 μ within the photographic emulsion. (auth)

10663

ON THE LINEAGE OF ACTINIUM K: Fr^{223}_{87}. M. Perey and M. J. P. Adloff. J. phys. radium 17, 545-7(1956) July. (In French)

Refer also to abstracts 10465 and 10471.

RARE EARTHS AND RARE-EARTH COMPOUNDS

10664

MAGNETIC PROPERTIES OF TRIVALENT IONS OF EUROPIUM AND SAMARIUM. A. S. Borovik-Romanov and N. M. Kreines (Moscow State Inst.). Soviet Phys. JETP 2,

657-63(1956) July. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 790-7(1955) Dec. (In Russian)

The magnetic susceptibilities of Eu_2O_3, Sm_2O_3 (in two crystalline modifications) and $Sm_2(C_2O_4)_3 \cdot 10H_2O$ have been measured from 12 to 300°K. A strong dependence of the magnetic properties of the samarium ion on the crystalline structure of the compound in which it occurs was found. With a decrease in the effect of the crystalline field, the experimental curves of the temperature dependence of the magnetic susceptibility approximate the theoretical curve of Van Vleck for free ions. An apparatus for measuring magnetic susceptibility over a wide temperature interval is described. (auth)

10665

PARAMAGNETIC RESONANCE OF EUROPIUM AND GADOLINIUM IN FLUORIDES. Charles Ryter and Roger Lacroix. Compt. rend. 242, 2812-14(1956) June 11. (In French)

SHIELDING

10666 BNL-2713

Brookhaven National Lab., Upton, N. Y.

A REVIEW OF THE BROOKHAVEN SHIELDING PROGRAM. R. D. Schamberger and F. J. Shore. Sept. 1, 1955. 25p. $4.80(ph OTS); $2.70(mf OTS).

A review of the history of shielding measurements at BNL shows that considerable emphasis has been placed on the acquisition and application of fundamental microscopic data and data from applied bulk mock-up or geometry tests. The relationship of the Brookhaven shielding facilities to the over-all shielding measurement program is discussed. Investigations carried out to date are presented in tabular form with remarks which briefly describe the various items and report references included. (C.H.)

10667 ER-8018

Martin (Glenn L.) Co., Baltimore.

NUCLEAR RADIATION HEATING. Barney L. Byrum and John A. Biggerstaff. Jan. 1956. 52p. Contract Nonr-1612(00).

The problem of heat generation in a reactor γ shielding material is defined, and a technique that is adequate for establishing preliminary design requirements is developed. The results are presented in a manner facilitating application by the designer of the best pertinent experimental data which may be made available from time to time. As an example, the heat generation distribution in a slab of iron six inches thick is estimated for a given set of parameters. (auth)

10668 TID-3303

Technical Information Service Extension, AEC.

RADIATION SHIELDS AND SHIELDING: A BIBLIOGRAPHY OF UNCLASSIFIED REPORT LITERATURE. July 1956. 20p. $0.20(OTS).

This bibliography contains 77 annotated references to unclassified reports on radiation shields and shielding. References are included to reports written prior to November 1954. Author, subject, and report number indexes are provided. (auth)

Refer also to abstract 10387.

SPECTROSCOPY

10669 ORNL-2154

Oak Ridge National Lab., Tenn.

A SURVEY OF PLUTONIUM SPECTRUM DATA. J. R. McNally, Jr. Sept. 10, 1956. 151p. Contract W-7405-eng-26. $22.80(ph OTS); $7.20(mf OTS).

Published data on the spectra of Pu have been compiled into a single tabulation. (T.R.H.)

10670

ISOTOPE SHIFT IN THE SPECTRA OF Ne II and W. I. Kiyoshi Murakawa (Inst. of Science and Tech., Tokyo). J. Phys. Soc. Japan 11, 778-80(1956) July.

The isotope shift in the transition 3s−3p in the spectrum of Ne II (Ne^{22} — Ne^{20}) was observed, using a liquid-air cooled hollow cathode. The shift in the doublet spectrum of the ^3P system was found to be of the order of 0.2 cm^{-1} and larger than that in the quartet spectrum or the ^1D system. The component due to the rare isotope W^{180} was detected in the line λ4269 of the spectrum of W I, and the ratio of the distances of the neighboring even isotopes was found to be $\Delta(186-184) : \Delta(184-182) : \Delta(182-180) = 1 : 1.206 \pm 0.010 : 0.88 \pm 0.07$. (auth)

10671

APPARATUS FOR SPECTROGRAPHIC STUDIES UP TO 600 ATMOSPHERES. J. Robin and B. Vodar (Laboratoire des Hautes Pressions, Bellevue, Sein-et-Oise). J. phys. radium 17, 500-1(1956) June. (In French)

10672

RESPONSE OF A SODIUM-IODIDE SCINTILLATION SPECTROMETER TO 10- TO 20-MILLION-ELECTRON-VOLT ELECTRONS AND X-RAYS. H. W. Koch and J. M. Wyckoff. J. Research Natl. Bur. Standards 56, 319-35 (1956) June.

The response of a large-crystal NaI spectrometer was studied for individual monoenergetic electrons extracted from a 50-Mev betatron operated between 1 and 20 Mev. The energy resolution with crystals 5 inches in diameter by 4 inches in length and 5 inches in diameter by 9 inches in length reaches its optimum value for electrons of 6 Mev, where the total width of the pulse-height distribution at half maximum if 4%. Syntheses of pulse-height distributions for 11- and 19-Mev monoenergetic X-ray photons are made by using the experimental electron pulse-height distributions. The computed results compare favorably with the measured pulse-height distributions for 11.6- and 17.6-Mev gamma rays. Syntheses provide one of the few procedures for predicting spectrometer response functions in this x-ray energy range. (auth)

10673

RESPONSE FUNCTION OF THALLIUM-ACTIVATED SODIUM-IODIDE SCINTILLATION COUNTERS. Martin J. Berger and J. Doggett. J. Research Natl. Bur. Standards 56, 355-66(1956) June.

Measurements of γ rays with NaI(Tl) crystals yield pulse height distributions related to the true energy spectrum by an integral equation whose kernel (response function) is the probability that an incident photon of energy E will give rise to a pulse of size E'. The response function has been calculated by the Monte Carlo method for photons with energies from 0.279 to 4.45 Mev. Results are presented for cylindrical crystals ranging in size from 0.25 (radius) by 0.5 inch (length) to 2.5 by 9 inches. They are based on the analysis of 50,000 photon histories sampled with the use of the Standards Electronic Automatic Computer (SEAC). Analytical corrections were made for the escape of annihilation radiation and bremsstrahlung from the crystal. (auth)

THEORETICAL PHYSICS

10674 AERE-Lib/Trans-669

THE LAW OF PROPORTIONAL RESISTANCES AND ITS APPLICATION TO PRESSURE IN SAND AND EXPLOSIONS.

Friedrich Kick. Translated by F. Hudswell from Dinglers Polytech. J. 250, 141-5(1883). 6p.

The work required for identical deformations of bodies identical except for size (mass) are proportional to the weights or volumes of the bodies. The pressure required (for the same situation) are proportional to corresponding cross sectional areas of the bodies. This law is experimentally applied to pressures in sand and explosions and is verified. (T.R.H.)

10675

EXISTENCE OF QUANTUM STATIONARY STATES OF POINT NUCLEONS WHICH INTERACT WITH THE MESON FIELD. S. I. Pekar (Physics Inst. of the Ukraine SSR Academy of Sciences). Soviet Phys. JETP 2, 462-5(1956) May. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 299-604(1955) Nov. (In Russian)

Investigation is carried out of the problem of the existence of stationary quantum states of a system consisting of point nucleons which interact with a field of neutral and charged mesons. Various types of interaction operators between the nucleon and the meson-field are considered. With the motion of the nucleons treated non-relativistically, the absence of stationary states is proved for the case when the interaction is of a pseudo-vector character. The proof involves none of the approximations employed, for example, in the weak or strong coupling method. (auth)

10676

THE THEORY OF STRONG COUPLING FOR MESON FIELDS. I. B. T. Geilikman (Moscow State Teachers' Inst.). Soviet Phys. JETP 2, 509-19(1956) May. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 417-29(1955) Oct. (In Russian)

Scalar and pseudoscalar meson fields which interact with infinitely heavy extended nucleons are considered in the strong coupling approximation. A theory of excitation is developed in the reciprocal coupling constant of the nucleons with the meson field. (auth)

10677

THE STRONG COUPLING THEORY OF MESON FIELDS. II. B. T. Geilikman (Moscow State Teachers' Inst.). Soviet Phys. JETP 2, 601-7(1956) July. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 430-8(1955) Oct. (In Russian)

In an earlier paper the problem of nucleons interacting with a meson field has been treated by perturbation theory, using as the expansion parameter the reciprocal coupling constant. On that basis, the interaction of two nucleons, the scattering of mesons from nucleons, and the bound states of mesons are calculated for the case of the infinitely heavy nucleons. (auth)

10678

THEORY OF STRONG COUPLING FOR MESON FIELDS. III. B. T. Geilikman (Moscow State Teachers' Inst.). Soviet Phys. JETP 2, 451-61(1956) May. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 572-84(1955) Nov. (In Russian)

Examination is made of the pseudoscalar meson field which interacts with moving nucleons in the strong coupling approximation. A theory is developed which takes into account the polarization of the nucleonic vacuum. (auth)

10679

ASYMPTOTIC BEHAVIOR OF ELECTROMAGNETIC VACUUM-POLARIZATION IN THE PRESENCE OF MESON INTERACTIONS. V. B. Berestetskii. Soviet Phys. JETP 2, 540-9(1956) May. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 585-98(1955) Nov. (In Russian)

It is shown that, when $e^2 \ll g^2 \ll 1$, the asymptotic form of the photon propagation function is the same as in the case $g^2 = 0$, where g is the meson-nucleon coupling constant, and e is the electric charge. (B.J.H.)

10680

MESON CORRECTIONS IN THE THEORY OF BETA DECAY. S. S. Gershtein and Ia. B. Zel'dovich. Soviet Phys. JETP 2, 576-8(1956) May. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 698-9(1955) Nov. (In Russian)

Some remarks are made on the work of Finkelstein and Moszkowski concerning the effect of strong coupling between nucleons and pions on the β decay of nucleons. It is stated that their calculations do not follow for renormalization of the nucleon wave function as a result of the possibility of creating virtual mesons and do not consider the possibility of β conversion of mesons. Corrected calculations are summarized. (B.J.H.)

10681

INTERACTION OF NUCLEONS THROUGH A PSEUDO-SCALAR MESON FIELD. A. A. Rukhadze (P. N. Lebdev Physical Inst., Academy of Sciences, U.S.S.R.). Soviet Phys. JETP 2, 570-1(1956) May. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 709-11(1955) Nov. (In Russian)

Tamm's method was applied to the problem of the interactions of nucleons through a pseudoscalar meson field. (B.J.H.)

10682

SOLUTION OF THE EQUATIONS OF PSEUDO-SCALAR MESON THEORY WITH PSEUDO-SCALAR COUPLING. I. Ia. Pomeranchuk (Academy of Sciences, U.S.S.R.). Soviet Phys. JETP 2, 739-41(1956) July. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 869-71(1955) Dec. (In Russian)

10683

EFFECTS OF NONDEGENERACY OF NUCLEAR GROUND STATE ON LOW-ENERGY NEUTRON REACTIONS. K. A. Brueckner (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 103, 172-81(1956) July 1.

The imaginary part of the potential acting on a neutron moving in the nucleus is shown to be very sensitive to the departure of the nuclear ground-state wave function from that of an independent-particle model. The nucleon-nucleon interaction which gives rise to the neutron absorption also leads to correlation structure in the nuclear wave function. This manifests itself both in the partial emptying of the independent-particle states near the Fermi momentum and in the velocity dependence of the real part of the average potential seen by the neutron. These effects are determined by using interaction operators derived in studies of the nuclear saturation problem. The result is that the velocity dependence of the potential reduces V_{Im} by a factor of about eight; the departure of the nuclear state from complete degeneracy gives an increase of roughly 5 in the opposite direction. Thus, the two effects nearly cancel so that the final prediction for V_{Im} at a density corresponding to $R = 1.40 \times 10^{-13} A^{1/3}$ cm is close to the empirical value. It is also found that V_{Im} decreases rapidly for higher nuclear densities, suggesting that the neutron absorption may be primarily a surface phenomenon. (auth)

10684

FORMAL THEORY OF NUCLEAR MODELS. Nobuyuki Fukuda (Indiana Univ., Bloomington). Phys. Rev. 103, 420-5(1956) July 15.

The formal theory of nuclear model operators discussed by Eden and Francis is presented from a somewhat different point of view. Our way of approach is, first, to introduce the model space $\mathcal{M}$ of arbitrary dimension which is composed of simple known wave functions; second, to transform the original Schrödinger equation into that in the model space, the model wave function and the model Hamiltonian being defined in an unambiguous way; third,

to obtain the integral equation for the model operator which also determines the model Hamiltonian. This equation no longer contains the exact eigenvalues as in the work of Eden and Francis and is shown to have a unique solution in some cases. The formal relation of this theory to the nuclear scattering problem is discussed. (auth)

10685

APPROXIMATION METHOD FOR HIGH-ENERGY POTENTIAL SCATTERING. L. I. Schiff (Stanford Univ., Calif.). Phys. Rev. 103, 443-53(1956) July 15.

An approximation method for high-energy potential scattering is developed that expresses the scattered amplitude in terms of a quadrature, similar to the Born approximation but superior to it in accuracy. It is valid when the potential is slowly varying compared to a wavelength, $|V|/E'$ is small compared to unity, θ is either small or large compared to $(kR)^{-\frac{1}{2}}$, and $|V|R/\hbar\nu$ is unrestricted in magnitude, where E', θ, k, and ν are the kinetic energy, scattering angle, wave number, and speed of the scattered particle, and V and R are rough measures of the strength and range of the scattering potential, which may be complex. For comparison, the Born approximation requires that $|V|R/\hbar\nu$ be small compared to unity. The procedure consists in summing the infinite Born series after approximating each term by the method of stationary phase. Both the Schrödinger and Dirac equations are treated, and it is expected that the method can be extended to the scattering theory of other wave equations. The relation of the present work to previous work of others is discussed, and the limitations of WKB or eikonal-type approximations are explored. The method is expected to be especially useful for calculating the scattering of fast electrons, neutrons, and protons from non-spherical nuclei. (auth)

10686

ALPHA-PARTICLE MODEL OF C^{12}. A. E. Glassgold (Univ. of Minnesota, Minneapolis) and A. Galonsky (Oak Ridge National Lab., Tenn.). Phys. Rev. 103, 701-3(1956) Aug. 1.

The α-particle model for C^{12} has been re-examined. In addition to correlating the 0^+, 2^+, and 0^+ states at 0, 4.43, and 7.65 Mev, respectively, two possible identifications are given for the 9.61-Mev level: 1^- or 2^+. These levels completely determine the model, and the position and character of all levels up to 15 Mev are given. The main defect of the model is its prediction of a 3^- state at 5.53 Mev which has never been observed. The separation of the α particles in C^{12} is 3.7×10^{-13} cm and the mean zero-point kinetic energy per vibrational degree of freedom is about 2 Mev. (auth)

10687

EFFECT OF π-π INTERACTION ON HIGH-ENERGY π-p SCATTERING. A. N. Mitra (Muslin Univ., Aligarh, India). Phys. Rev. 103, 752-9(1956) Aug. 1.

The possibility of explaining the second maximum in (π-p) scattering in the framework of the Tamm-Dancoff approximation for (π-p) interaction is examined by postulating a resonant π-π interaction in the isotopic spin state I = 0 of the π-π system. For this purpose the Tamm-Dancoff method in pseudoscalar theory, as formulated by Dyson and others, is first extended so as to include the effects of a π-π interaction. This is achieved by introducing a Green's function whose form is determined on the assumption of a zero-range π-π interaction in the state I = 0 of the π-π system. The solution of the "modified" integral equation is greatly simplified by assuming the π-p interaction to be weak compared with the π-π interaction. The total inelastic cross section is then derived by using the unitary property of the S matrix. It is found that the Tamm-Dancoff approximation is unable to explain the (π-p) maximum on the basis of the proposed model. This is contrary to the result derived by other authors, who used the impulse approximation for the interaction of the incident meson with the meson cloud surrounding the nucleon. (auth)

10688

ON MULTIPLE PRODUCTION OF PHOTONS. G. Eder (Max-Planck-Institut fur Physik, Gottingen). Nuovo cimento (10) 3, 885-92(1956) May. (In German)

The theory of multiple photon production from high-energy electron and meson reactions is discussed. (D.E.B.)

10689

ON A TWO DIMENSIONAL THEORY OF THE INTERACTION BETWEEN A PARTICLE WITH SPIN ½ AND THE ELECTROMAGNETIC FIELD. E. Minardi. Nuovo cimento (10) 3, 968-78(1956) May. (In Italian)

10690

ON THE MEANING OF FERMI COUPLING. B. Jouvet (Univ. of Copenhagen). Nuovo cimento (10) 3, 1133-5(1956) May.

The case of a scalar self-coupling of a spinor is shown to be identical to a Yukawa-type theory of a scalar meson whose experimental mass and coupling constant are functions of the Fermion constants. This identity is used to express the unrenormalized quantities of the Fermi theory in terms of the renormalized ones. (D.E.B.)

10691

ON THE BASIS OF THE UNIFIED MODEL OF BOHR-MOTTELSON. R. Nataf (College de France, Paris). J. phys. radium 17, 516(1956) July. (In French)

By symmetry (indiscernibility of nucleons) and rotation invariance requirements, one can express the "surface" dynamical variables of the Bohr-Mottelson theory as functions of the coordinates of all the nucleons, and take these as redundant dynamical variables together with the coordinates. However, having performed the corresponding transformation on the Schrödinger Hamiltonian, it was found that the simple empirical rotational levels cannot be derived from it. (auth)

Refer also to abstracts 10463 and 10464.

TRACER APPLICATIONS

10692

DEVELOPMENT OF A TRACER TECHNIQUE. FINAL REPORT. Available from OTS as PB 111952 for $2.25.

The development of an air tracer technique using ethane was studied in four phases, selection and preparation of a tracer gas, development of a gas dispenser, an air sampler, and an analytical method. (auth)

URANIUM AND URANIUM COMPOUNDS

10693 AERE-E/R-514

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE AXIAL CONTRACTION OF IRRADIATED URANIUM RODS (BARS). J. Woodrow. Apr. 1950. 12p.

By considering an improved simple model, it is shown that a progressive axial contraction is produced by differential thermal cycling provided that the yield points satisfy the following condition $2\sigma_0'(T + \Delta T) < \sigma_0(T)$ and the applied temperature difference ΔT satisfies the inequality $\Delta T > (3\sigma_0'(T + \Delta T) + 1.5\ \sigma_0'(o))/E\alpha$. The contraction per complete cycle is given by $\delta L = l_0 \{\alpha\Delta T - (3\sigma_0'(T + \Delta T))/E - (1.5\sigma_0'(o))/E\}$. (auth)

10694 AERE-M/R-1944

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE BETA TO ALPHA PHASE CHANGE IN PURE URANI-

UM. PART I. THE NATURE OF THE PHASE CHANGE. PART II. THERMAL CYCLING THROUGH A MARTENSITIC PHASE CHANGE. B. R. Butcher. May 1956. 26p.

A review of the literature establishes that there is some controversy over the nature of the $\beta \rightarrow \alpha$ phase change in pure U. Crystallographic and metallographic experiments which were undertaken to clarify the position are described. It is concluded that the transformation is martensitically nucleated, and that the growth of the nuclei is probably martensitic. It is suggested that in a martensitic phase change, lattice faults are transferred from one phase to the other. The implications of this are discussed for thermal cycling of a simple postulated metal. The assumptions about this simple metal are then discarded one by one, and the attendant modifications of the ideas are considered. Finally, the thermal cycling of U through the α/β phase change is examined. (auth)

10695

FISSION NEUTRON SPECTRUM OF U^{235}. L. Cranberg, G. Frye, N. Nereson, and L. Rosen (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 103, 662-70(1956) Aug. 1.

The neutron spectrum associated with the fission of U^{235} induced by slow neutrons has been remeasured from 0.18 to 12 Mev. Two different experimental techniques were employed in this measurement: (1) the time-of-flight method covering the energy range from 0.18 to 2.7 Mev, and (2) the photographic plate method encompassing the energy range from 0.35 to 12 Mev. The combined results of these measurements fit the relation, $N(E) = Ke^{-E/0.965} \sinh[(2.29E)^{\frac{1}{2}}]$, where N(E) is the neutron flux, E is the neutron energy in Mev and K is a constant. The simpler expression, $N(E) = KE^{\frac{1}{2}}e^{-0.775E}$, also fits the data well for neutron energies below 9 Mev. (auth)